

Appendix 5: Scoping review two: Social deprivation and development of CKD



Why are people who are socially deprived more likely to develop CKD than those who are not?

A systematic scoping review

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A research project funded by Kidney Research UK

1. Introduction, aims and objectives

This report seeks to examine the relationship between social deprivation and the development of chronic kidney disease (CKD) in the United Kingdom (UK).

The aims of the report are to:

1. Understand why people who are socially deprived are more likely to develop CKD than those who are not socially deprived
2. Provide a map of the literature in relation to different types of social deprivation and risk factors
3. Identify gaps in the literature in relation to different types of social deprivation, risk factors and stages of kidney disease
4. Learn lessons from other developed countries in achieving better outcomes for socially deprived groups.

It will do this by:

1. Reporting on a systematic scoping review of the literature to identify the evidence base of the relationship between social deprivation and CKD
2. Mapping the evidence according to country/area
3. Drawing up a set of key findings from the results of the review and mapping
4. Identifying opportunities for further research

2. Methods

The systematic scoping review was conducted in line with the five-stage framework outlined by Arksey and O'Malley (2005), and facilitated by four interactive training workshops. Four researchers attended the workshops, each taking forward one scoping review relating to CKD and contributing to discussions regarding the remaining three reviews. Workshops were facilitated by an academic with expertise in systematic searches and systematic reviewing. The content of the workshops broadly followed the five stages of a systematic scoping review set out by Arksey and O'Malley (2005). These included: protocol and search question development; systematic searching and record management; sifting and refining; charting and mapping. Within this report the four researchers and the academic are referred to as the project team.

2.1 Identifying the research question

The research question was initially determined via a Delphi study as outlined in chapter three of this report and then refined via discussion within the project team to 'Why are people who are socially deprived more likely to develop CKD than those who are not?'

This will include the identification of studies that examine or consider social deprivation at any stage of CKD pre-dialysis. Social deprivation will be defined as having low socioeconomic status, as considered by low income, low education attainment, housing tenure, occupation, or living below the official poverty line of the country where the research takes place (where this is possible to ascertain).

2.2 Identifying relevant studies

A comprehensive and iterative approach to the literature searches for evidence was taken to ensure that the range of perspectives was captured. This included sources from health, psychology, and sociology. The research team developed a protocol at the outset that was agreed and modified throughout the search and filtering process to ensure the review was manageable and conducted within the required timeframe and answered the initial research question.

Literature searches

Searches were undertaken in July and August 2017, by the researcher, guided by an experienced health information specialist following discussions with the project team according to the agreed protocol. A time frame of 1992 onwards was set to capture evidence from the last 25 years.

Resources searched

Nine electronic databases were searched to identify studies for inclusion in the review. A full list can be found in appendix one of this scoping review. There was insufficient time within the project to search journals and grey literature that could have expanded the potential range of studies to be included.

Search terms

The search was wide and sensitive and encompassed a range of thesaurus and free text terms to describe the different types of social deprivation and the capture the terms related to chronic kidney disease. The search strategies for each database can be found in appendix two of this report.

Process of searching

The search followed the agreed protocol and was undertaken by a researcher with support from an experienced health information specialist. Results of the searches were stored on Endnote web reference management software. The Endnote group function was used to enable the team to track references throughout the systematic review process.

2.3 Study selection

Inclusion and exclusion criteria

The inclusion and exclusion criteria were initially set out in the protocol by the project team following a scoping search. As the screening process continued the criteria were refined through project team discussions then applied to all search results in Endnote web. The final inclusion and exclusion criteria are listed below.

Include:

- Studies which examine an aspect of social deprivation in relation to CKD. It is anticipated that the type of aspects which will be considered will include culture, income, inequality, class, education and nutrition
- Evidence relating to prognosis
- All stages CKD pre-dialysis
- Adults
- Studies in English, post 1992

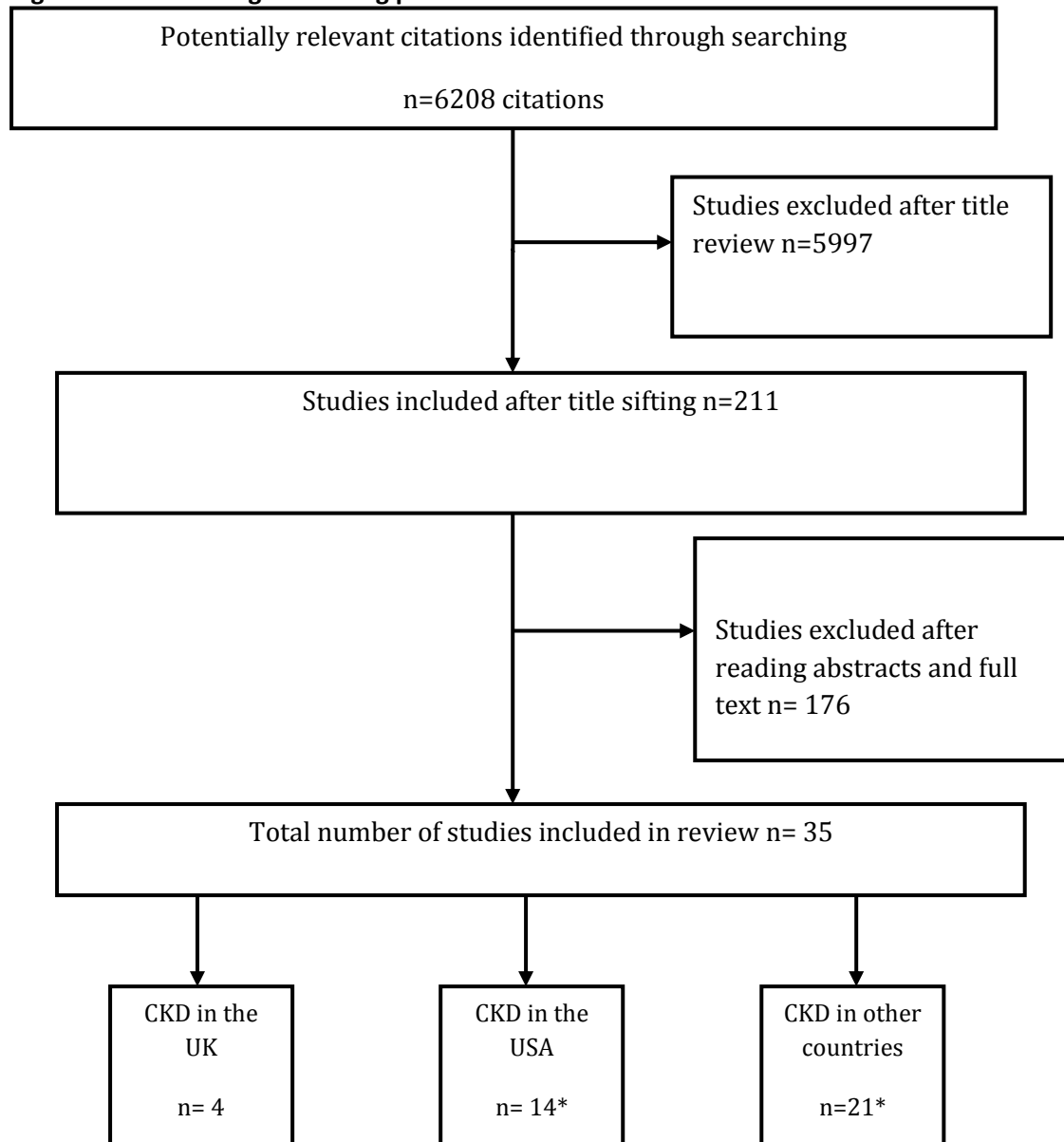
Exclude:

- Studies outside the agreed definitions of social deprivation
- Main focus/prognosis is obesity or diabetes
- Studies in languages other than English
- Children under the age of 18
- Books or theses
- Dialysis or transplant patients
- Expert opinion and non-systematic reviews

Screening/Sifting of studies

All records were uploaded on to the Endnote database. Using the inclusion and exclusion criteria, each record was screened independently on the basis of title by the researcher, Dr Michael Rees. A 10% sample of titles was screened by a second member of the research team; any discrepancies were resolved by discussion. Studies were then screened by abstract and full text as shown in figure one below.

Figure One: searching and sifting process



* Four studies (25, 26, 31, and 32) have been included in both sections as they focus on both the USA and other countries

2.4 Charting the data

Data was extracted into a single evidence table by the researcher following project team discussions regarding the column headings and data to be extracted. The evidence table can be found in appendix three of this scoping review.

2.5 Collating, summarising and reporting the results

A table was created to summarise the key findings of the papers identified as being appropriate (see appendix three of this scoping review). The country/countries the papers discussed, study design, aspect and definition of social deprivation considered and the applicability of the papers to an understanding of the relationship between social deprivation and the development of CKD in the UK

were all noted. Separate tables were considered for each geographical area but considering the small number of papers found the decision was made to keep them together. Each of the studies is numbered; these numbers are used in the findings discussion below. Illustrative examples from the key findings are used to understand the relationship between social deprivation and CKD in various contexts.

3. Findings

3.1 Social deprivation and CKD in the United Kingdom

3.1.1 Overview

Just four studies (3, 8, 13, and 30) focus explicitly on the relationship between social deprivation and CKD in the UK. Using occupational grade, salary, index of multiple deprivation (IMD) scores, educational qualification, housing tenure and ownership of a motor vehicle as markers of social deprivation these studies all identify an increased incidence of CKD among those who are socially deprived.

3.1.2 Notable Studies

Bello et al.'s (8) study 'investigated the relationship between SES and severity of CKD in a retrospective, cross-sectional analysis involving 1657 patients at the Sheffield Kidney Institute' (2008: 1316) and is interesting in examining not only why those from socially deprived backgrounds are more likely to develop CKD but typically present with more severe CKD. The authors used multiple deprivation scores, which combine a range of economic, social, and housing issues, into a single deprivation score in their analysis. Given the worse outcomes for those from socially deprived backgrounds with CKD further knowledge of why they present with more severe CKD is a distinct challenge.

3.1.3 Key Findings

- 'Participants in a lower compared with higher occupational grade were at increased odds of having decreased GFR (age- and sex-adjusted OR, 1.31; 95% CI, 1.12-1.53; $P < 0.001$). Socioeconomic disparity in impedance-derived lean mass index (LMI) was evident in women, but not men. After further adjustment for BMI and components of metabolic syndrome, the odds of decreased GFR in whites with a lower compared with higher occupational grade was attenuated by 23.3% (OR, 1.23; 95% CI, 1.06-1.45; $P = 0.008$). Adjustment for LMI explained 15% of the association between SES and estimated GFR' (Al-Qaoud et al. 2001: 389)
- Participants [in the Whitehall II study] with a lower occupational grade were at 31% increased odds of decreased GFR (age- and sex-adjusted odds ratio [OR], 1.31; 95% confidence interval [CI], 1.12-1.53; $P < 0.001$) in comparison to those in a higher occupational grade. There was no evidence for a difference in the occupational grade effect on GFR between men and women. Adjusting for BMI attenuated the association by 14.4%, and adjustment for all components of metabolic syndrome attenuated the association by 20%. Adjustment for serum high-density lipoprotein (HDL) cholesterol and triglyceride (dyslipidemia) levels decreased the excess odds of having decreased GFR in individuals in lower grades by 17.6%, whereas adjustment for BMI and dyslipidemia combined decreased the risk by 23.3%. Adjustment for non-HDL cholesterol level and prevalent diabetes (data not

shown) did not attenuate the odds appreciably. Adjustment for age, sex, BMI, and all components of metabolic syndrome did not result in greater attenuation. The occupation grade effect remained significant in the maximally adjusted model. (Al-Qaoud et al. 2001: 393)

- We show in a UK white population of 5,533 men and women that individuals of lower SES more often have early kidney function decrease compared with those of higher status measured using civil service occupational grade. Our study implicates obesity and metabolic syndrome in the association between SES and decreased GFR, whereby each independently explains about one-sixth and in combination account for almost a quarter of the increased odds of having decreased GFR seen in individuals with lower SES status. Our results are in line with previous studies that have examined the role of individual income and education in CKD. In contrast to our findings, Peralta et al. (2006) found that occupation (based on white- and blue-collar criteria) was not associated with kidney function in either African American or white participants from the Cardiovascular Health Study. Using a life course approach, Shoham et al showed that ORs for CKD in working class versus non-working class individuals at age 30 years were 1.4 (95% CI, 1.0-1.9) in whites and 1.8 (95% CI, 1.1-3.0) in blacks. A case-control study in Sweden (Fored et al. 2003) involving 1,894 participants aged 18-74 years used highest occupation grade of spouses and parents as a measure of household SES and found that women in families with only unskilled workers had a 2-fold increase in odds of CKD in comparison to women in families of professionals. The corresponding excess odds of preuremic CKD in men was 60% in the lowest versus highest household SES. These findings show that associations between grade/social class and CKD are present for both men and women (Al-Qaoud et al. 2001: 393 - 394)
- 'The age-adjusted prevalence of diagnosed CKD at presentation by area of residence, across the five deprivation quintiles, per million population was Q1 1495, Q2 3530, Q3 3398, Q4 3989, and Q5 19,599. Logistic regression models showed that living in the lowest SES quintile area (Q5) as compared with the highest SES (Q1) was associated with a greater risk for presenting with a lower estimated GFR, after adjustment for sociodemographic, lifestyle, and clinical variables' (Bello et al. 2008: 1316)
- The crude distribution of prevalent CKD for the Sheffield wards stratified by the IMD quintiles is depicted in Figure 1 [reproduced below]. The darker shaded areas indicate the higher prevalence rate of CKD. The figure illustrates a clear pattern of higher prevalence of CKD within the socioeconomically deprived areas of residence (wards), in comparison with the least deprived areas (Figure 1). Figure 2 [reproduced below] illustrates the IMD-derived deprivation scores for the same geographic units of the city. Again, the darker shading indicates the higher socioeconomic deprivation, and a visual inspection reveals that the areas of high deprivation map onto the areas of high CKD prevalence rates as shown in Figure 1. As a sensitivity analysis, an alternative socioeconomic deprivation score, directly derived from the 2001 census, the UV67 table of household characteristics, was used. Using these data, Figure 3 [reproduced below] confirmed a similar geographic pattern to the CKD rates represented in Figure 1. Figure 4 [reproduced below] shows an increasing trend in the number of patients presenting with advanced CKD (stage 5) to the [renal] unit from the least deprived (Q1) to the most deprived category (Q5; $P=0.012$ for trend) (Bello et al. 2008: 1318-1319)

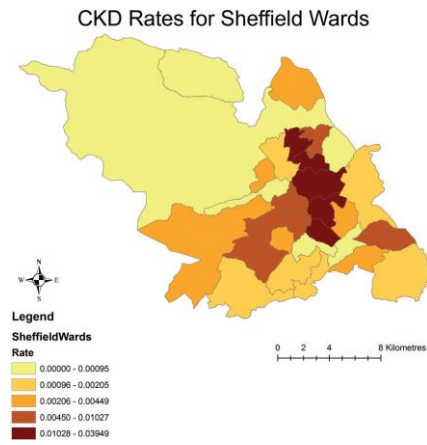


Figure One

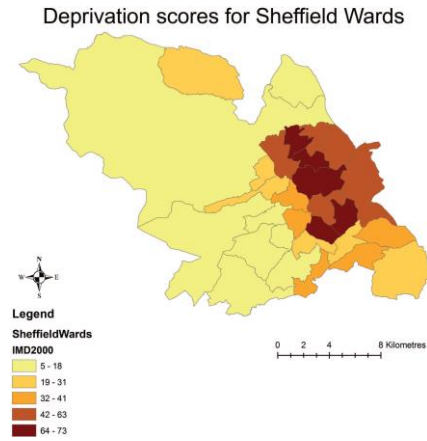


Figure Two

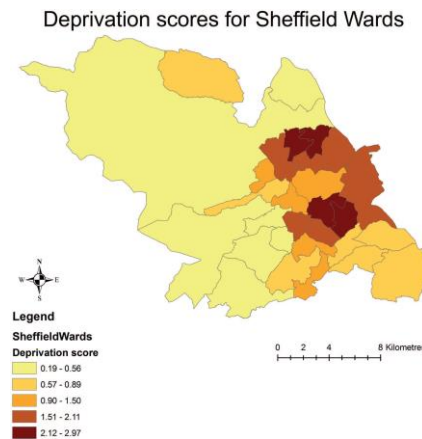


Figure Three

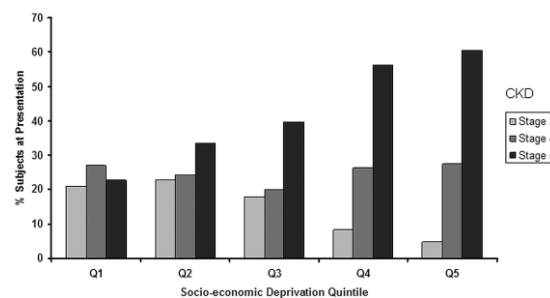


Figure Four

- 'The prevalence of CKD 3–5 was 5.2% and albuminuria 8.0%. Age–sex-adjusted CKD 3–5 was associated with lack of qualifications [odds ratio (OR) 2.27 (95% confidence interval 1.40–3.69)], low income [OR 1.50 (1.02–2.21)] and renting tenure [OR 1.36 (1.01–1.84)]. Only tenure remained significant in fully adjusted models suggesting that co-variables were on the causal pathway. Albuminuria remained associated with several SES measures on full adjustment: low income [OR 1.55 (1.14–2.11)], no vehicle [OR 1.38 (1.05–1.81)], renting [OR 1.31 (1.03–1.67)] and most deprived area-level quintile [OR 1.55 (1.07–2.25)]' (Fraser et al. 2013: 1)
- 'Higher CKD 3–5 prevalence was associated with lack of qualifications, low income and housing tenure (renting) after adjusting for age and sex. These associations were not maintained after further adjustment for ethnicity, lifestyle and clinical variables (obesity, diabetes, hypertension and smoking), which are likely to be explanatory factors on the causal pathway. Higher albuminuria prevalence was associated with low income, lack of vehicle ownership, housing tenure (renting) and IMD, and these were maintained, though attenuated, after full adjustment, demonstrating independence from these key factors on the causal pathway' (Fraser et al. 2013: 11)
- 'Eighteen thousand two hundred and eighty-five [patients] (5.8%) had CKD stage 3–5 on 31 March 2011. SES, rurality and patients to general practitioner ratio (PGR) predicted 39% ($F(3,50) = 12.37$, $P < 0.001$) of the variation in prevalence with SES exerting the most influence (25%)' (So et al. 2015: 1010)
- 'After standardization for age and gender, SES was found to have a strong positive association with CKD prevalence' (So et al. 2015: 1012)

- 'The mechanism by which low SES is associated with increased CKD prevalence is not clear. Other factors associated with CKD are known to be more common in lower SES populations, including obesity, smoking, diabetes mellitus and vascular disease and so low SES may simply be a composite marker for these' (So et al. 2015: 1016)

3.1.4 Applicability to the UK

As all four studies were conducted within the UK they are all directly relevant to understanding the relationship between social deprivation and CKD in the UK. So et al.'s (2015) (30) study is focused on Scotland and explores rurality and patient to general practitioner ratio. It is likely that these findings are applicable to other areas of the UK though further research is needed to ascertain this.

3.2 Social deprivation and CKD in the United States of America

3.2.1 Overview

Fourteen studies (2, 5, 21-29, 32, 33, 34) examine the relationship between social deprivation and CKD in the United States of America. These studies consistently link social deprivation – as defined by low socioeconomic status – with higher incidence of CKD. Race is a key issue in many of these studies with African-Americans and Hispanics having higher rates of CKD compared to their white counterparts, a finding that may not be surprising given that race and low socioeconomic status are closely correlated. However, low socioeconomic status remains a significant factor even after race is controlled for in these studies.

3.2.2 Notable studies

Barr et al.'s (2003) (5) study, though mostly focused on progression, provides interesting insights by using neighbourhood-based measures of socioeconomic status to assess the relationship between poverty and CKD; this is something that may be adopted for UK studies as discussed below. Shoham et al.'s two papers (2007; 2008) (28 and 29) are interesting for adopting a class based approach exploring the relationship between class and risk of developing CKD across the life course. The second of these papers is notable for drawing on the notion of cultural capital and habitus to explain how class based lifestyle choices (for example smoking, eating and drinking habits) impact upon the greater propensity for those who are socially deprived to develop CKD.

3.2.3 Key findings

- 'Several studies have highlighted a strong association between SES and the incidence, prevalence, and complications of CKD.22-32 In an analysis of over 14,000 adults in the third National Health and Nutrition Examination Survey III, we found the presence of poverty, defined as less than 200% federal poverty level (FPL), was associated with a 35% greater odds of prevalent microalbuminuria and a 78% greater odds of prevalent macroalbuminuria. However, after adjusting for age, sex, race, education, obesity, hypertension, diabetes, reduced estimated glomerular filtration rate (eGFR), and medication use, the odds of prevalent microalbuminuria was less robust but still significant (18%; P , .05), but the association with macroalbuminuria was no longer significant' (Nicholas et al. 2015: 7)
- 'In a cohort of nearly 2500 community dwelling black and white adults aged 30 to 64 years residing in Baltimore City, MD, stratified by SES (household income ,125% FPL or higher).

Crews and colleagues (2010) found that low SES was independently associated with a 59% greater odds of CKD prevalence after adjusting for demographics, insurance status, and comorbid disease, but there was no difference by race. However, when stratified by race, low SES was associated with CKD in African Americans, but not in whites, suggesting that the role of SES to CKD may differ across racial/ethnic groups' (Nicholas et al. 2015: 8)

- 'The impact of individual or household income vs community poverty level on CKD outcomes is not clear. To investigate this issue, McClellan and colleagues reported data from over 22,000 participants in the Reasons for Geographic and Racial Differences in Stroke cohort study in the Southeast United States, finding household income (\$15,000) vs community poverty (25% of the community households were below the FPL), and found that household income, but not community poverty, was independently associated with CKD (eGFR 10-59 mL/min/1.73 m²) prevalence' (Nicholas et al. 2015: 9)
- 'Poverty and social disadvantage are associated with a higher risk of CKD and CKD progression' (Hossain et al. 2009; Jha et al. 2013; Merkin et al. 2005; Merkin et al. 2007) (Said and Hernandez 2015: 39)
- 'Krop et al. (1999) found that individuals who live in households with incomes below \$16,000 per year have 2.38 times the risk of early kidney function decline as those who lived in households making at least \$35,000 per year; individuals with less than a high school education had 1.67 times the risk of kidney function decline as those with a college education' (Shoham et al. 2005: 57)
- 'The adjusted odds ratio of CKD for persons belonging to the working class versus non-working class at age 30 was 1.4 (95% confidence interval, 1.0 to 2.0) in whites and 1.9 (95% confidence interval, 1.1 to 3.0) in African Americans. Working class membership was associated with CKD, even at earlier stages of adult life, and class was associated more strongly with CKD than was education. Working class membership also suggested a stronger association with CKD among African Americans than whites, independent of diabetes and hypertension status' (Shoham et al. 2007: 217)
- 'Subjects with CKD tended to have lower educational attainment and area SES scores and were more likely to have been members of the working class at each age period' (Shoham et al. 2007: 220)
- 'Being working class for all life course periods or for some life course periods was associated with increased odds of CKD, compared to being non-working class for all periods (adjusted odds ratio, OR, for all periods (95% confidence interval) 1.4 (0.9, 2.0) in Whites and 1.9 (1.3, 2.9) in African-Americans; OR for some periods 1.3 (1.0, 1.9) in Whites and 1.4 (0.9, 2.2) in African-Americans). Low area SES over the life course was not significantly related to CKD compared to living in a higher SES areas at all life course periods. Adjustment for age, gender, community of residence, cumulative social class (for neighbourhood measures), cumulative low-neighbourhood SES (for cumulative individual social class), hypertension and diabetes does not account for these associations' (Shoham et al. 2008: 1311)
- 'The relationship between low SES and CKD was statistically significant after adjustment for age, sex, and race (P <0.001)' (Vart et al. 2015b: 391)
- 'Smoking, alcohol intake, and physical inactivity contributed 8%,7%, and 4%, respectively, to the total effect of low SES on CKD. Twenty percent of the total effect of SES on CKD was explained by health-related behaviours. Regarding comorbid conditions, the direct as well as indirect effects operating via diabetes, hypertension, obesity, abdominal obesity, and

hypercholesterolemia were significant. Diabetes and hypertension explained 13% and 7% of the association between low SES and CKD, respectively; obesity and abdominal obesity explained 4% each; and hypercholesterolemia explained 3%. Comorbid conditions together explained 32% of the association between low SES and CKD' (Vart et al. 2015b: 391-392)

- 'Age- and gender-adjusted odds of having chronic kidney disease were increased 86% for US Whites in the lowest income quartile versus the highest quartile (odds ratio [OR]=1.86; 95% confidence interval [CI]=1.27, 2.72). Odds were increased 2 times and 6 times, respectively, among unemployed (not retired) versus employed non-Hispanic Black and Mexican American participants (OR=2.89; 95% CI=1.53, 5.46; OR=6.62; 95% CI=1.94, 22.64. respectively)' (White et al. 2008: 1306)
- 'Income in the lowest quartile, shorter duration of education, and being unemployed were associated ($P<.01$) with significantly increased odds of eGFR at less than 60 mL/min/1.73 m² on crude analysis among US non-Hispanic Whites [and] US non- Hispanic Blacks' (White et al. 2008: 1308)

3.2.4 Applicability to the UK

As a country that is culturally and economically similar to the UK, there may be some findings from these studies that are applicable to the UK. However, caution should be exercised as economic inequalities and social deprivation are more keenly felt in the USA when it comes to health disparities due to the very different health systems that operate in the two countries. The free health care offered in the UK should mitigate against health disparities more than in the USA though this needs to be explored in more depth. However, access to free universal healthcare available in the UK is more likely to have a positive effect on progression and outcomes of CKD rather than on development of CKD. Nevertheless, the findings consistently identify a pattern between social deprivation – whether defined by income, education, occupation, neighbourhood, or a combination of these – and an increased likelihood to develop CKD and so mirrors the findings of those studies that have been conducted in the UK (see above). Propositions as to the reasons for increased likelihood to develop CKD among the social deprived include comorbidity factors such as higher rates of diabetes and hypertension, poorer eating habits, smoking, drinking and obesity – all similar issues faced in the UK and disproportionately affecting the social deprived.

3.3 Social deprivation and CKD – global perspectives

3.3.1 Overview

Twenty-one studies (1, 4, 6-7, 9-12, 14-20, 25-26, 31, 32, 34-35) examine the relationship between CKD and social deprivation from a global perspective though the focus of these articles is varied. Some studies that have examined CKD from a global perspective focus on developed countries such as USA, United Kingdom and Australia (for example Hossain et al. 2009 (15); Said and Hernandez 2015 (26)) and findings mirror those discussed in sections 3.1 and 3.2. Others focus on the magnitude of CKD in developing countries, including India (1), Sri Lanka (1), Egypt (7), Mexico (4, 9), Brazil (6, 11) and China (16, 35), or look at worldwide trends in the relationship between social deprivation and CKD in developing countries. Poverty, as measured in various ways, including the World Bank criteria of gross national income per capita (GNI) (7)), as well as occupation (25), housing status (25, 31) and education (26, 31, 32) is a key determining factor in the higher incidence of CKD

in both developed and developing countries though lack of access to clean drinking water and work environment are also identified as determining factors in the latter.

3.3.2 Notable studies

Plantiga (2012) (25) conducted a systematic review of socio-economic status and CKD with associated poor outcomes. The author examines income, occupation, education, wealth, and housing situation as markers of socio-economic status and the effect these have on the development of CKD. The author notes that income is the most studied aspect of socio-economic status considered. For all aspects of socio-economic status, social deprivation, as evidenced by lower status of income, education etc., is correlated to increased incidence of CKD. Vart et al.'s (2015) (35) systematic review and meta-analysis is also excellent as it pools together various markers of socio-economic status to 'summarize the strength of the associations between SES and CKD' (2015: 580). They concluded that 'socioeconomic disparities in CKD were fairly strong, irrespective of how SES was measured' (ibid.). Both of these have findings that may be applicable to the UK though further research is needed to substantiate this.

3.3.3 Key findings

- 'Contaminated surface water seems to be an important factor, as prevalence of CKDu is low (1.5%) where water is obtained from deep wells, natural springs and pipe-borne town water and the prevalence is high (7.7%) in those areas using shallow dug wells, stream water and water tanks [Sri Lanka]' (Abraham et al. 2016: 138).
- 'Practically all relevant parameters such as infant and maternal mortality, life expectancy, incidence and prevalence of communicable and many non-communicable diseases, etc., are negatively affected by poor economy. Chronic kidney disease (CKD) is one of the areas where this effect has been particularly prominent, with an inverse relationship in-between national income and the incidence and prevalence of CKD' (Barsoum 2010: 44).
- 'Of the modifiable factors for the initiation of CKD in the community, hypertension and diabetes are the most common; however, obesity, dyslipidemia, and smoking have also been implicated. *SES therefore may impact directly or indirectly on the susceptibility to and progression of CKD*' (Hossain et al. 2006: 170, my emphasis)
- 'People in the lowest socioeconomic quartile are at a 60% greater risk of progressive chronic kidney disease than are those who are in the highest quartile' (Jha et al. 2013: 267) – analysis of National Health and Nutrition Examination Survey data in the United States
- 'Disadvantaged populations across the globe exhibit a disproportionate burden of chronic kidney disease (CKD) because of differences in CKD occurrence and outcomes. Although many CKD risk factors can be managed and modified to optimize clinical outcomes, the prevailing socioeconomic and cultural factors in disadvantaged populations, more often than not, militate against optimum clinical outcomes. Disadvantaged populations, particularly in developing countries, frequently exhibit multiple risk factors for CKD and harbour non-traditional risk factors such as schistosomiasis, tuberculosis and amyloidosis (Barsoum 2003). Environmental pollution, pesticides, analgesic abuse, herbal medications, and unregulated food additives also contribute to the disproportionate burden of CKD in many disadvantaged populations worldwide (Kher et al. 2002) (Martins et al. 2012: 1)

- ‘Information on occupation as a risk factor for CKD or its outcomes is less abundant. A case-control study in Sweden showed that individuals with CKD were more likely to come from families with only unskilled workers compared to families with professional workers... Similarly, lower occupational grade was cross-sectionally associated with greater odds of decreased eGFR in a United Kingdom study’ (Plantiga 2012: 3-4)
- ‘In the ARIC study [16], individuals with less than a high school education had 1.7 times the risk of kidney function decline versus those with a college education. Similar associations were seen in the Jackson Heart Study and in a population-based case-control study in Sweden... Finally, in an observational cohort of the Kidney Early Evaluation Program (KEEP) study, Choi et al. found that lower educational attainment was associated with greater prevalence of CKD’ (Plantiga 2012: 4)
- ‘Socioeconomic disparities in CKD were fairly strong, irrespective of how SES was measured’ (Vart et al. 2015: 580)
- ‘The results of this study suggest that compared to those with high SES, people with low SES have a fairly strong association with CKD defined by low eGFR, high albuminuria, low eGFR/high albuminuria, or renal failure. Different definitions of SES were not related to the strength of associations between low SES and any of the CKD measures’ (Vart et al. 2015: 583)
- ‘Variables like race, gender, family structure, and geography can interact with SES in association between SES and CKD. For example, at the same level of education, African Americans are more likely to experience unemployment or have lower income than whites in the U.S. A similar trend might be true for women. Consequently, the effect of low education on CKD might be different across races and genders’ (Vart et al. 2015: 589)

3.3.4 Applicability to the UK

There may be some lessons that can be learned regarding racial and ethnic differences, and the effect of lead and other heavy metal exposure on CKD development (26 and 34) from those articles that focus on CKD in developing countries but given the large socioeconomic differences between the UK and developing countries, and the improved health and safety environment in the UK, there is little that is applicable to the UK in these papers. Some of the papers draw on studies conducted in the USA (25, 26, 31, and 32) so the evidence in these may have some applicability as outlined in 3.2.4. Those that have been conducted in other developed countries such as Australia (34) and Sweden (12) demonstrate that those who are socially deprived, whichever measure used, are more likely to develop CKD *after* factors such as age, gender, and race are controlled for and so offer insights into the relationship between SES and CKD that may be useful in consideration of this relationship in the UK.

4. Discussion

4.1 Social deprivation and CKD

This scoping review has provided an overview of those papers that have explored the relationship between social deprivation and CKD. The number of papers is small, particularly those that focus explicitly on the UK, meaning there is scope for further research as outlined below. Evidence from research conducted demonstrates that those who are social deprived, as defined by various

measures, are more likely to develop CKD than their less disadvantaged counterparts. Reasons proposed for the higher incidence of CKD in socially deprived patients include comorbidity factors, lifestyle choices such as eating and drinking habits, a distrust of traditional medicine, smoking, area of residence, and unsafe working environments. This needs to be researched in more depth to understand the complex interplay between geographical location, occupation, and lifestyle choices, on the higher incidence of CKD among those who are socially deprived.

4.2 Gaps in the evidence and opportunities for further research

There is a general lack of research that specifically addresses why those from socially deprived backgrounds are more likely to develop CKD but this is even more acute in the UK, and so there exists a gap that needs to be filled. While more research exists on the effects of social deprivation on renal replacement therapy (Caskey et al. 2006; Caskey 2013), dialysis (Chow 2005) and transplantation (Udayaraj et al. 2010), we need to better understand the development of CKD among those who are socially deprived, particularly in the UK. There is a severe lack of primary research into the effects of social deprivation on CKD in the UK (just four studies, as discussed above) so I would recommend that further primary research is conducted, notably in the following areas:

1. Research to develop a better understanding of why those who are socially deprived are more likely to develop CKD
2. Research to develop a better understanding of why those who are socially deprived typically present with more severe CKD
3. Research to develop a better understanding of why those who are socially deprived have worse outcomes than their non-deprived peers

In particular, I would propose that Shoham et al.'s 2008 study (29) that explores how cultural capital impact upon habits such as smoking and drinking – significant comorbidity factors for CKD – provides a useful model for research in the UK.

Having established the reasons for those who are socially deprived being a higher risk for developing CKD I would propose intervention studies aimed at reducing this disparity through, for example, targeted education programmes.

4.3 Strengths and limitations of the method

The project was undertaken over a short time with limited resources. The systematic scoping method used, provides a means of systematically identifying the available literature, highlighting the approach used, and explicitly stating the gaps in searching and identifying evidence. The purpose of a scoping review is to use a rigorous, non-biased approach to map the available literature; this allows broad questions and areas to be considered.

The search approach was sensitive but due to the broad nature of the question, it is likely that some studies have been missed; indeed, papers that were read referenced other studies that were not included which could potentially have been. Within the project time frame and resources, further searching to identify and include these papers was not possible. Ideally citation tracking would have been conducted as well as a more extensive search for grey literature.

Finally, a scoping review does not critically appraise or assess the papers in detail. Data was extracted regarding the outcomes of interest, but detailed critical appraisal of the studies was not performed. Thus, the propositions and recommendations for further research are based on a high-level overview of the studies available rather than an in-depth examination of the literature in each area

5. Conclusion

There is clear evidence that those who are socially deprived – regardless of the measures used to ascertain social disadvantage – have higher incidence of CKD. More research, as outlined above in 4.2, needs to be conducted to understand the reasons for this, and more importantly to develop measures that attempt to reduce this disadvantage.

Though evidence from other developed countries such as America, Australia, and Sweden, provides useful information for an understanding of social deprivation and CKD more specific focus on the uniqueness of the issues faced by socially disadvantaged UK citizens is needed.

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Appendix One: Resources searched

Database name	Focus	Access
Medline	Biomedical	
Cinahl	Nursing and allied health	
Psychinfo	Psychology/Mental Health	
Web of Science/Web of Knowledge	Science/Social Sciences	
Social Care Online	Social Care	
ASSIA	Social Science	
Cochrane Database of Promoting Health Effectiveness Reviews	Systematic Reviews	
Proquest	Social Science	
SocIndex	Sociological	

Appendix Two: Search strategies

General keywords for incorporating into searches:

Kidney/or Kidney Diseases/or Renal Insufficiency/or Renal Dialysis/or Renal Replacement Therapy/or Glomerular Filtration Rate

Socioeconomic Factors/or cultural deprivation/or Poverty/inequality/or Homeless Persons/or Unemployment

Medline

1. Kidney/
2. exp Kidney Diseases/
3. exp Renal Insufficiency/
4. exp Renal Dialysis/
5. exp Renal Replacement Therapy/
6. exp Glomerular Filtration Rate/
7. 17 or 18 or 19 or 20 or 21 or 22
8. exp Socioeconomic Factors/
9. exp cultural deprivation/
10. exp Poverty/
11. inequality.mp.
12. exp Homeless Persons/
13. exp Unemployment/
14. 4 or 25 or 26 or 27 or 28 or 29
15. 23 and 30
16. research/ or exp biomedical research/ or exp empirical research/ or exp research design/ or exp research report/ or exp social validity, research/
17. exp Research Design/
18. 32 or 33
19. 31 and 34
20. limit 31 to (autobiography or biography or clinical study or clinical trial, all or comparative study or controlled clinical trial or evaluation studies or government publications or interview or meta analysis or observational study or personal narratives or pragmatic clinical trial or randomized controlled trial or "review" or systematic reviews)
21. 35 or 36

CINHAL

1. kidney
2. kidney AND deprivation
3. (MH "Kidney+")
4. MH "Polycystic Kidney, Autosomal Dominant")
5. (MH "Polycystic Kidney, Autosomal Recessive")
6. (MH "Renal Insufficiency+")
7. (MH "Renal Insufficiency, Chronic+")

8. (MH "Kidney Diseases+")
9. (kidney) AND (S1 OR S2 OR S3 OR S4 OR S5 OR S6 OR S7 OR S8)
10. (MH "Glomerular Filtration Rate")
11. (MH "Socioeconomic Factors+")
12. (MH "Social Determinants of Health")
13. (MH "Cultural Deprivation")
14. "deprivation"
15. (MH "Poverty+")
16. "inequality"
17. (MH "Homeless Persons")
18. (MH "Homelessness")
19. (MH "Unemployment")
20. S10 OR S11 OR S12 OR S13 OR S14 OR S15 OR S16 OR S17 OR S18 OR S19
21. S9 AND S20
22. (MH "Research+")
23. (MH "Study Design+")
24. S22 OR S23
25. TI Review or synthesis or trial or meta-analysis or evaluation or cohort study or case control
or survey or qualitative or research
26. S24 OR S25
27. S21 AND S26

Psychinfo

1. exp KIDNEYS/
2. exp Kidney Diseases/
3. renal insufficiency.mp.
4. exp Dialysis/
5. renal replacement.mp.
6. glomerular filtration.mp.
7. 1 or 2 or 3 or 4 or 5 or 6
8. exp SOCIOECONOMIC STATUS/
9. exp Cultural Deprivation/
10. exp POVERTY/
11. exp Social Equality/
12. exp Income Level/
13. inequality.mp.
14. exp HOMELESS/
15. exp UNEMPLOYMENT/
16. 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15
17. 7 and 16

Web of Science

1. TOPIC: (kidney)
2. TOPIC: (kidney diseases)

3. TOPIC: (renal insufficiency)
4. TOPIC: (renal dialysis)
5. TOPIC: (renal replacement therapy)
6. TOPIC: (glomerular filtration rate)
7. #6 OR #5 OR #4 OR #3 OR #2 OR #1
8. TOPIC: (socioeconomic)
9. TOPIC: (cultural deprivation)
10. TOPIC: (poverty)
11. TOPIC: (inequality)
12. TOPIC: (homeless)
13. TOPIC: (unemployment)
14. #13 OR #12 OR #11 OR #10 OR #9 OR #8
15. #14 AND #7

ASSIA

((kidney AND pd(>19920101)) OR (kidney disease AND pd(>19920101)) OR (renal insufficiency AND pd(>19920101)) OR (renal dialysis AND pd(>19920101)) OR (renal replacement AND pd(>19920101)) OR (glomerular filtration AND pd(>19920101))) AND (socioeconomic OR (cultural deprivation) OR poverty OR inequality OR homeless OR unemployment)

Cochrane

1. MeSH descriptor: [Culture] explode all trees
2. MeSH descriptor: [Cultural Deprivation] explode all trees
3. MeSH descriptor: [Kidney] explode all trees
4. #1 or #2
5. #4 and #5

ProQuest Sociology

(kidney OR (kidney disease) OR (renal insufficiency) OR (renal dialysis) OR (renal replacement) OR (glomerular filtration)) AND (socioeconomic OR (cultural deprivation) OR poverty OR inequality OR homeless OR unemployment)

SocINDEX

1. kidney
2. kidney disease
3. renal insufficiency
4. renal dialysis
5. renal replacement therapy
6. glomerular filtration rate
7. (glomerular filtration rate) AND (S1 OR S2 OR S3 OR S4 OR S5 OR S6)
8. socioeconomic factors
9. cultural deprivation
10. inequality
11. homeless

- 12. unemployment
- 13. socioeconomic status
- 14. (socioeconomic status) AND (S8 OR S9 OR S10 OR S11 OR S12 OR S13)
- 15. ((socioeconomic status) AND (S8 OR S9 OR S10 OR S11 OR S12 OR S13)) AND (S7 AND S14)

Appendix Three: Evidence table

Author/Date	Country	Study Aims	Study Design	Aspect of Social Deprivation	Definition of Social Deprivation	Key Findings	Applicability to UK	Notes
1. Abraham et al. 2016	South Asia - Various	Discussion		Poverty/ Developing Countries	Financial	<p>Children from India with LBW or small for gestational age are extremely vulnerable and at risk of developing renal injury with subtle and trivial insults [as adults]</p> <p>Contaminated surface water seems to be an important factor, as prevalence of CKDu is low (1.5%) where water is obtained from deep wells, natural springs and pipe-borne town water and the prevalence is high (7.7%) in those areas using shallow dug wells, stream water and water tanks (Sri Lanka).</p> <p>CKDu is a major economic issue for the government, as it affects, for the most part, those who are poor.</p>	No	
2. Agoda, L. 2003	US	Discussion	Report	Poverty	Financial - associated with race and ethnicity	<p>The earlier onset and more severe renal disease in racial and ethnic minority populations may be partly explained by the lifestyle factors and lesser access to health care, compounded by lower socioeconomic status</p> <p>Some argue that because of their lower socioeconomic status, in general, African Americans are less likely to receive early and adequate medical care.</p> <p>However, there is no documentation that African Americans in the lower socioeconomic strata have higher incidence rates of hypertensive renal disease, compared to African Americans in the higher strata.</p>	Yes	
3. Al-Qaoud et al. 2001	United Kingdom	Show the association between socioeconomic status (SES) and decreased kidney function in a European context and explore the role of obesity and metabolic syndrome.	Cross-sectional	Poverty	Self-reported occupational grade/salary range	<p>Participants in a lower compared with higher occupational grade were at increased odds of having decreased GFR (age- and sex-adjusted OR, 1.31; 95% CI, 1.12-1.53; P 0.001). Socioeconomic disparity in LMI was evident in women, but not men. After further adjustment for BMI and components of metabolic syndrome, the odds of decreased GFR in whites with a lower compared with higher occupational grade was attenuated by 23.3% (OR, 1.23; 95% CI, 1.06-1.45; P 0.008). Adjustment for LMI explained 15% of the association between SES and estimated GFR.</p> <p>It has been widely documented that those who are less affluent and/or of an ethnic minority background are over-represented in persons who develop established kidney failure.</p> <p>Participants with a lower occupational grade were at 31% increased odds of decreased GFR (age- and sex-adjusted odds ratio [OR], 1.31; 95% confidence interval [CI], 1.12-1.53; P 0.001) in comparison to those in a higher occupational grade (Table 4).</p> <p>These findings show that associations between grade/social class and CKD are present for both men and women.</p>	Yes	
4. Amato et	Mexico	Assess the prevalence	A population-based	Poverty	Educational level and	Educational level < primary school, and income <US \$4.00/day were	Some	

Author/Date	Country	Study Aims	Study Design	Aspect of Social Deprivation	Definition of Social Deprivation	Key Findings	Applicability to UK	Notes
al. 2005		of chronic kidney disease in a Mexican urban population residing in Mexico and to evaluate certain biologic and socioeconomic conditions as risk factors for the development of renal disease.	cross-sectional survey was conducted, which included 3564 patients of either gender aged >18 years, who were randomly selected from lists of patients assigned to primary care facilities in the city of Morelia		income	<p>significantly associated with reduced Ccr</p> <p>Also, the increase in the ESRD incidence rate in Mexican Americans is greater than that in black or white Americans</p> <p>Our results show that this Mexican population living in Mexico has prevalence rates of CKD similar to or higher than those in developed countries with national registries of renal patients.</p>		
5. Barr et al. 2003	America	Studies of proliferative lupus nephritis (PLN) suggest that African-Americans have a poorer prognosis than Whites. However, no study has simultaneously examined socio-economic status. We studied rates of progression of PLN among a tri-ethnic population with respect to socio-economic status and race/ethnicity.	A retrospective cohort study was carried out using individual and census-based neighbourhood data. Consecutive patients in urban tertiary care centres with biopsy-proven PLN were studied.	Poverty/SES status	<p>We used neighbourhood-based measures of SES from census data [15]. Each case was geo-coded to a census-defined neighbourhood, based on the subject's address at the time of initial biopsy. These census-defined neighbourhoods, termed 'block groups', consist of 1000 residents each. Age, gender and race/ethnic-specific socio-economic data were extracted from the 1980 and 1990 US census, and variables were dichotomized. High poverty was defined as >10% of neighbourhood residents living below the Federal poverty line. Low median household income was defined as a median household income <\$25 000. Low education attainment was defined as >45% of residents not completing high school, and low assets was defined as <10% of residents reporting any income from interest or dividends</p>	<p>In bivariate analyses, residence in a poor neighbourhood was positively associated with progression (P<0.03)</p> <p>Residence in a poor neighbourhood remained associated with progression of disease after adjustment for age, sex, creatinine, hypertension, cyclophosphamide treatment and race/ethnicity [relative risk (RR) 3.5, 95% confidence interval (CI) 1.2–11, P<0.03].</p> <p>Poverty is an important risk factor for progression of PLN, independent of race/ethnicity. Hispanics have an elevated risk similar to or greater than African-Americans. Given these findings, some of the poorer prognosis of African-American patients with PLN may result from socio-economic rather than biological or genetic factors.</p> <p>SES was found to account for these differences, suggesting that social and economic forces, not major underlying genetic differences, caused the observed disparities.</p> <p>In this tri-ethnic cohort of patients with PLN, poverty predicted progression of renal function independently of clinical and race/ethnic factors. In addition, we found that Hispanics had an elevated risk of progression of PLN similar to or greater than African-Americans, compared with Whites, and that differences between African-Americans and Whites were not independent of the effects of poverty.</p>	Yes	Progression

Author/Date	Country	Study Aims	Study Design	Aspect of Social Deprivation	Definition of Social Deprivation	Key Findings	Applicability to UK	Notes
6. Barreto et al. 2016	Brazil	There is increased interest in understanding why chronic kidney disease (CKD) rates vary across races and socioeconomic groups. We investigated the distribution of estimated glomerular filtration rate (eGFR), urinary albumin–creatinine ratio (ACR) and CKD according to these factors in Brazilian adults	Using baseline data (2008–2010) of 14 636 public sector employees (35–74 years) enrolled in the Brazilian Longitudinal Study of Adult Health (ELSA)-Brasil multicentre cohort, we estimated the prevalence of CKD by sex, age, race and socioeconomic factors. CKD was defined as ACR≥30 mg/g and/or eGFR<60 mL/min/1.73 m ² . GFR was estimated by CKD epidemiology collaboration without correction for race. We used logistic regression to estimate the association of race and socioeconomic position (education, income, social class and occupational nature) with CKD after adjusting for sex, age and several health-related factors.	SES status	Education, income, social class and occupational nature	<p>The prevalence of high ACR or low eGFR, in isolation and combined, increased with age, and was higher in individuals with lower socioeconomic position and among black individuals and indigenous individuals.</p> <p>Having high school (OR=1.15; 95% CI 1.00 to 1.34) or elementary education (OR=1.23; 95% CI 1.03 to 1.47) increased the odds for CKD compared to those having a university degree.</p> <p>The higher prevalences of CKD in individuals with lower educational status and in non-whites were not explained by differences in health-related factors.</p>	Some	
7. Barsoum 2010	Worldwide (Egypt)	Glomerulonephritis (GN) still enjoys a high rank as a cause of chronic kidney disease (CKD) worldwide. Its burden is particularly manifest in disadvantaged populations, with a proportional contribution up to 6-folds compared to that in the USA. There are	Cross-sectional	Poverty/ Developing Countries	According to the latest World Bank criteria based on the gross national income per capita (GNI), 84% of the world population falls into the low- (< \$ 975) or middle- (\$ 976 – \$ 11,905) income categories, hence being economically disadvantaged when	<p>Chronic kidney disease (CKD) is one of the areas where this effect has been particularly prominent, with an inverse relationship in-between national income and the incidence and prevalence of CKD</p> <p>Under similar climatic conditions, the proportional contribution of GN to incident ESRD, ranging from 11 to 40%, is inversely related to GNI with a few exceptions, probably related to reporting bias. Even within the same country, GN is more prevalent among the economically less privileged communities. However, since many of such communities are racially distinct, it is difficult to dissect the genetic effect from that of poverty.</p> <p>Low national income also reflects on education, leading to largely</p>	Some	

Author/Date	Country	Study Aims	Study Design	Aspect of Social Deprivation	Definition of Social Deprivation	Key Findings	Applicability to UK	Notes
		several overlapping risk factors that render a particular population “disadvantaged” in this respect. It is envisaged that these may be categorized into a triad of genetic, climatic and socioeconomic factors. An attempt is made to dissect the impact of each of these factors ... The socioeconomic impact, reflecting low national economy in the developing world, modifies the two other arms of the triad according to the level of primary care, efficiency of the referral system and adequate management of primary infections as well as associated glomerular injury			compared to the high- (> \$ 11,906) economy categories	illiterate communities, driven by wrong habits and intuition. Among the most common are the lack of confidence in the medical profession and strong belief in traditional medicines, witch doctors, sangomas and magicians in many underdeveloped communities. In addition to overlooking any reversible factors associated with GN, a lot of harm may be induced by unknown prescriptions and procedures.		
8. Bello et al. 2008	UK	Low socioeconomic status (SES) is associated with both development and progression of chronic kidney disease (CKD). The impact of SES on severity of CKD at presentation to a renal service is less well known. This study investigated the relationship between SES and severity of CKD in a retrospective, cross-sectional analysis involving 1657 patients at the Sheffield Kidney Institute (Sheffield, UK).	SES was assigned to each patient according to electoral ward of residence by postcode and ranked according to the corresponding British Index of Multiple Deprivation score, which comprises five deprivation quintiles (Q1, least deprived; Q5, most deprived). National Kidney Foundation Kidney Disease Outcomes Quality Initiative classification of CKD was used for stratification and analysis. Binary logistic regression analysis was applied	Deprivation	Multiple Deprivation Score. The IMD combines a number of indicators, chosen to cover a range of economic, social, and housing issues, into a single deprivation score for each small area (ward) in England. Separate indices at ward level are provided for each of the six domains of deprivation: Income, employment, health deprivation and disability, education skills and training, barriers to housing, and services. This allows all wards to be ranked according to how deprived they are	<p>The age-adjusted prevalence of diagnosed CKD at presentation by area of residence, across the five deprivation quintiles, per million population was Q1 1495, Q2 3530, Q3 3398, Q4 3989, and Q5 19,599. Logistic regression models showed that living in the lowest SES quintile area (Q5) as compared with the highest SES (Q1) was associated with a greater risk for presenting with a lower estimated GFR, after adjustment for sociodemographic, lifestyle, and clinical variables.</p> <p>Low SES is related to severity of CKD at presentation. Further studies are needed to examine this issue across the various SES categories in the United Kingdom.</p> <p>The figure illustrates a clear pattern of higher prevalence of CKD within the socioeconomically deprived areas of residence (wards), in comparison with the least deprived areas (Figure 1).</p> <p>Control for the risk factors associated with CKD did not cancel completely the observed relationship between low SES (Area deprivation) and severe CKD. A previous study in UK also found the incidence of diagnosed/referred CKD to be greater in the more deprived areas, with poorer prognosis and decreased survival</p>	Yes	

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			for the association of variables/risk factors with CKD (lower GFR) at presentation.		relative to each other.	<p>Of note, SES on its own does not affect kidney function or link directly with onset of CKD, but the associated biologic exposures would explain fully or in part its relationship with CKD. There are several ways in which low SES (area deprivation) could influence CKD distribution in the community. These could be demographic (age, gender, and ethnic variation influences) clinical (hypertension, diabetes, and hyperlipidemia), behavioral (diet, obesity, smoking, alcohol, and recreational drug use), or the differences in health care delivery system (access, referral pattern, and awareness among primary health care providers)</p> <p>Overall, the classical CKD risk factors did not explain fully the relationship between area-level low SES and advanced CKD in this study.</p>		
9. Chudek et al. 2013	Poland	The aim of this study was to assess the prevalence of CKD and its relation to socioeconomic conditions in the Polish elderly population.	<p>A glomerular filtration rate estimated (eGFR) according to the CKD-EPI formula and urine albumin/creatinine ratio were determined in 3797 out of 4979 randomly selected elderly subjects from the national survey study PolSenior. Additionally, some socioeconomic factors related to the prevalence of CKD were also analysed.</p> <p>PolSenior was a multicentre, interdisciplinary project, conducted in the years 2007–2011, designed to assess health and socioeconomic status of the elderly population in Poland. The study design was described elsewhere [13]. The protocol was based on a standardized questionnaire (with</p>	Poverty/ Education	<p>Educational level was defined as a categorical variable with two levels: ‘low’ (below secondary school and <12 years of school-based training) and ‘high’ (high school or university diploma/degree—at least 12 years of school-based training).</p> <p>Poverty was defined if a self-reported income allowed purchase of the cheapest food and clothing.</p>	<p>Decreased eGFR was more frequent among less educated women, better educated men, blue collar female workers and white collar male workers.</p> <p>Only in women is higher educational status related to the lower risk of CKD.</p> <p>Decreased eGFR was more frequent in women ($P = 0.002$), and was associated with place of residence ($P < 0.001$), self-reported poverty ($P = 0.001$), smoking status ($P = 0.002$), alcohol consumption pattern ($P < 0.001$) and current (last year) regular physical activity ($P < 0.001$). Increased ACR was more frequent in men ($P < 0.001$) and was associated with current physical activity ($P < 0.001$). CKD was associated with place of residence ($P = 0.001$), self-reported poverty ($P = 0.002$), smoking status ($P = 0.02$), alcohol consumption pattern ($P < 0.001$) and current physical activity ($P < 0.001$).</p> <p>Stratification for gender of other socioeconomic factors showed some differences between women and men. Decreased eGFR was more frequent among less-educated women ($P < 0.001$) and among more-educated men ($P < 0.001$), and more frequent among blue collar female workers ($P < 0.001$) and among white collar male workers ($P < 0.001$).</p> <p>Additionally, decreased eGFR was more frequent among less-educated women and moreeducated men, as well as among blue-collar female workers and white-collar male workers.</p> <p>In the U.S. population, CKD disproportionally affects the poor. The relationship between low socioeconomic status and CKD in NHANES has an indirect nature, related to the higher prevalence of CKD risk factors, such as obesity, diabetes, hypertension and cardiovascular diseases in poor people. Contrary to this report, the prevalence of CKD was not related to the economic status of the elderly Polish population.</p>	Some	Elderly population who are more likely to develop CKD

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			elements of comprehensive geriatric assessment), blood pressure, anthropometric measurements, and blood and urine sample collection					
10. Dalstra et al. 2005	Europe	Few studies have compared socioeconomic inequalities in the prevalence of both fatal and non-fatal diseases. This paper aims to give the first international overview for several common chronic diseases	Micro-level data were pooled from non-standardized national health surveys conducted in eight European countries in the 1990s. Surveys ranged in size from 3700 to 41 200 participants.	Educational Level	Education was selected as the socioeconomic indicator, since it was measured in a fairly comparable way between countries. For each country, a group containing the lowest education levels (no education and primary education) and a group containing the higher education levels (secondary education, post secondary education, and tertiary education) of the International Standard Classification of Education (ISCED) were distinguished	<p>Most diseases showed higher prevalence among the lower education group.</p> <p>No socioeconomic differences were evident for cancer, kidney diseases, and skin diseases</p> <p>There are large variations between chronic diseases in the size and pattern of socioeconomic differences in their prevalence</p>	Some	Article has quite a broad focus on 11 different diseases and groups kidney stones and other kidney diseases together.
11. de Azevedo Barros 2011	Brazil	The aims of this study were to evaluate the 2008 prevalence of chronic diseases in Brazilian population comparing to 2003 data and to measure the social inequalities on the prevalence of the surveyed diseases according to educational strata	Data were obtained from the Brazilian National Survey (PNAD - health supplement) carried out on 2003 (sample of 384 764 individuals) and 2008 (sample size of 391 868). Prevalence and adjusted prevalence ratios were estimated using Poisson Multiple Regression with svy commands of Stata v.11.	Educational Level		All the 12 analysed diseases, with the exception of cancer and tendinitis/ tenosynovitis, showed significant higher prevalence on low educational level strata. The larger social inequalities were observed for chronic kidney failure (PR¼2.11), cirrheses (PR¼2.74), tuberculosis (PR¼1.74) and arthritis/rheumatism (PR¼1.51).	No	This is a poster session and so does not contain the full article. The full article only published in Portuguese though translations using Google/Windows translate is available.
12. Forel et al. 2003	Sweden	Low socio-economic status is associated with the occurrence of several different	All native residents from May 1996 to May 1998, aged 18–74 years, formed the	Socioeconomic status	An occupational-based socio-economic classification scale and educational level were	In families with unskilled workers only, the risk of chronic renal failure was increased by 110% [ORs2.1; 95% confidence interval (CI), 1.1–4.0] and 60% (ORs1.6; 95% CI, 1.0–2.6) among women and men, respectively, relative to subjects living in families in which at least	Yes	The article focuses on CRF with some patients who presented with

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		chronic diseases, but evidence regarding renal disease is scant. To explore whether the risk of chronic renal failure varies by socio-economic status, we performed a population-based case-control study in Sweden	source population. Cases (ns926) were incident patients with chronic renal failure in a pre-uraemic stage. Control subjects (ns998) were randomly selected within the source population. Exposures were assessed at personal interviews and relative risks were estimated by odds ratios (OR) in logistic regression models, with adjustment for age, sex, body mass index (BMI), smoking, alcohol consumption and regular analgesics use.		used as measures of SES.	<p>one member was a professional. Subjects with 9 years or less of schooling had a 30% (ORs1.3; 95% CI, 1.0–1.7) higher risk compared with those with a university education.</p> <p>Low socio-economic status is associated with an increased risk of chronic renal failure. The moderate excess was not explained by age, sex, BMI, smoking, alcohol or analgesic intake. Thus, socioeconomic status appears to be an independent risk indicator for chronic renal failure in Sweden.</p>		CRF but others had underlying health and/or existing kidney issues already. Not able to determine differences between these two groups in the article.
13. Fraser et al. 2013	UK	The relationship between chronic kidney disease (CKD) and SES is less clear. This study examined the relationships between SES and CKD and albuminuria in England.	<p>Data from the Health Survey for England 2009 and 2010 were combined. The prevalence of CKD 3–5 and albuminuria was calculated, and logistic regression used to determine their association with five individual-level measures and one area-level measure of SES.</p> <p>Cross-sectional</p>	Various	<p>Socioeconomic factors selected included: (i) occupation using National Statistics Socioeconomic Classification²³ [NS-SEC, in three categories: high (managerial and professional occupations), middle (intermediate occupations) and low (routine and manual occupations)]; (ii) qualifications grouped as: degree (NVQ4/NVQ5/Degree or equivalent), below degree (higher education below degree or NVQ3/GCE A Level equivalent or NVQ2/GCE O Level equivalent or NVQ1/CSE other grade) and none (no qualification); (iii)</p>	<p>The prevalence of CKD 3–5 was 5.2% and albuminuria 8.0%. Age–sex-adjusted CKD 3–5 was associated with lack of qualifications [odds ratio (OR) 2.27 (95% confidence interval 1.40–3.69)], low income [OR 1.50 (1.02–2.21)] and renting tenure [OR 1.36 (1.01–1.84)]. Only tenure remained significant in fully adjusted models suggesting that co-variables were on the causal pathway. Albuminuria remained associated with several SES measures on full adjustment: low income [OR 1.55 (1.14–2.11)], no vehicle [OR 1.38 (1.05–1.81)], renting [OR 1.31 (1.03–1.67)] and most deprived area-level quintile [OR 1.55 (1.07–2.25)].</p> <p>CKD 3–5 and albuminuria were associated with low SES using several measures. For albuminuria this was not explained by known measured causal factors.</p> <p>This study found socioeconomic disparities in the prevalence of CKD stage 3–5, using the CKD-EPI equation to define CKD, for individual measures of SES. It also identified socioeconomic disparities in the prevalence of albuminuria, an independent predictor of poor outcomes, for a wide range of both individual and an area-level measures of SES.</p> <p>Higher CKD 3–5 prevalence was associated with lack of qualifications, low income and housing tenure (renting) after adjusting for age and sex. These associations were not maintained after further adjustment for ethnicity, lifestyle and clinical variables (obesity,</p>	Yes	

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					household income tertiles; (iv) household tenure (owned or rented accommodation); (v) access to motor vehicle within the household (any versus none) and (vi) area-level deprivation [using Index of Multiple Deprivation 2007 (IMD) national quintiles: 1 least deprived (IMD 0.37–8.32), 2 (8.32–13.75), 3 (13.75–21.22), 4 (21.22–34.42) and 5 most deprived (34.42–85.46)]	<p>diabetes, hypertension and smoking), which are likely to be explanatory factors on the causal pathway. Higher albuminuria prevalence was associated with low income, lack of vehicle ownership, housing tenure (renting) and IMD, and these were maintained, though attenuated, after full adjustment, demonstrating independence from these key factors on the causal pathway.</p> <p>The reasons for finding association between SES and CKD and albuminuria may be partly related to the social distribution of underlying factors associated with CKD occurrence and progression, including obesity, smoking, type 2 diabetes and hypertension. Persistence of the association for albuminuria after adjustment suggests other causal mechanisms (and or potential residual confounding) may apply. Albuminuria is a key determinant of progression and poor outcome in CKD, particularly when combined with other risk factors (type 2 diabetes and hypertension), which are more prevalent in lower socioeconomic groups. Other factors such as low birth weight and health care access (with variation by health system) also show socioeconomic patterns.</p>		
14. Garcia-Garcia et al. 2013	Mexico	We screened 260 homeless individuals in the state of Jalisco, Mexico, for the presence of CKD and its risk factors, and compared their characteristics with those from a separate cohort of poor Jalisco residents and with a survey of the general Mexican population	Cross-sectional	Homelessness	Homeless was defined as a person who has no income of his or her own to satisfy basic needs, and who does not have a place to live.	<p>CKD was more prevalent among the homeless than among the poor Jalisco population (22% vs. 15.8%, P<0.0001); 16.5% had stage 3, 4.3% stage 4, and 1.2% stage 5. All were unaware of having CKD. Only 5.8% knew they had diabetes, but 19% had fasting blood sugar >126mg/dl; 3.5% knew they were hypertensive but 31% had systolic blood pressure >140mmHg or diastolic blood pressure >90mmHg. Alcoholism was less common than in the poor Jalisco population (23.5% vs. 32.3%, P<0.002), but tobacco smoking (34.6% vs. 21.5%, P<0.0001) and substance abuse (18% vs. 1.1%, P<0.0001) were more prevalent among the homeless. Likewise, chronic viral infections such as HIV (4.5% vs. 0.3%, P<0.0001) and HCV (7.7% vs. 1.4%, P<0.0001) were also significantly higher among the homeless than in the general population.</p> <p>Data from the Mexican National Health Survey 2000 indicate that risk factors for CKD are disproportionately higher among the poor</p> <p>CKD is a major public health problem in Mexico. It is estimated that 8% of the adult Mexican population has eGFR <60 ml/min per 1.73 m² (ref. 1) and that the prevalence is as high as 15.8% among high-risk, poor populations. Risk factors for CKD such as diabetes, hypertension, and obesity are highly prevalent in the Mexican population</p>	Some - homeless people in UK face similar issues to those in Mexico (i.e. health risks associated with CKD, lack of awareness of illness, non-compliance with medication)	
15. Hossain et al. 2009	Worldwide	It therefore is the objective of this review to describe the impact of SES on CKD and its major risk factors, diabetes and	Review	Poverty/ Developing Countries	Absolute poverty is classified by the World Bank as less than \$1/d or \$2/d. In developed countries, a measure of relative poverty is more	Growing evidence links poverty to chronic kidney disease (CKD). This may be caused by a direct impact of poverty on CKD or indirectly through the increased health care burden linked to poverty-associated diabetes and hypertension. Furthermore, data have shown that the poor and socially deprived have a greater prevalence of end-stage renal disease. Access to renal care, dialysis, and	Yes	

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		hypertension, in developed and developing countries.			usual, eg, the European Union defines this as an income less than 60% of the median income of the society. ^{6,7} Approximately 1.2 billion people in the world live in extreme poverty (\$1/d), and 2.7 billion live in moderate poverty (\$2/d; Fig 1)	<p>transplantation may also be affected by social deprivation. Overall, poverty and social deprivation are emerging as major risk markers for CKD in both developing and developed countries.</p> <p>an individual's socioeconomic stratification is a major determinant of his or her health. Second, the socioeconomic profile of areas where individuals live may have effects on their health regardless of their own SES</p> <p>There are considerable racial and ethnic variations in the incidence and prevalence of ESRD. In the United States, Australia, and the United Kingdom, the incidence/prevalence of ESRD is much greater in ethnic minorities compared with whites. These variations have been attributed to genetic, racial, and socioeconomic influences, including the limited access to health care provision of disadvantaged ethnic minorities that may predispose to CKD, as well as to a faster rate of progression to ESRD.</p> <p>Of the modifiable factors for the initiation of CKD in the community, hypertension and diabetes are the most common; however, obesity, dyslipidemia, and smoking have also been implicated. SES therefore may impact directly or indirectly on the susceptibility to and progression of CKD. It also may impact on risk factors for CKD and cardio- kidney damage in the community, such as hypertension, diabetes, and obesity</p> <p>A number of factors have been identified, primarily hypertension and diabetes. However, little attention has been given to date to the fact that these 2 major predisposing factors may be linked to social deprivation and poverty. This review shows strong links between social deprivation and factors leading to CKD and CVD, thus suggesting a radical change in emphasis to the prevention of CKD based on the identification and correction of issues related to poverty and impacting on kidney health care. Solutions that target social determinants of health care may in the long run impact positively on the current health care disparities affecting patients with diabetes, hypertension, and cardiokidney disease.</p>		
16. Jha et al. 2013	Worldwide	Review	Review	Poverty/ Developing Countries	Poverty	<p>The risk of chronic kidney disease is bi-directionally affected by level of economic development. Poverty increases the risk of disorders that predispose chronic kidney disease to develop or progress, and worsens outcomes in those who already have chronic kidney disease.</p> <p>An analysis of National Health and Nutrition Examination Survey data showed that poverty is associated with an increased risk of proteinuria even after correction for age, sex, ethnic origin, education, obesity, hypertension, diabetes, decreased glomerular filtration rate, and medication use. People in the lowest socioeconomic quartile are at a 60% greater risk of progressive chronic kidney disease than are those who are in the highest</p>	Some	Broad article with a focus on screening and economic costs (at macro level)

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						quartile. An interaction between ethnic origin and poverty has also been shown in minority and indigenous groups in many developed countries.		
17. Kim et al. 2015	Korea	The goal of this study was to examine the association of various demographic and socioeconomic factors with risk factors for chronic kidney disease (CKD).	We used nationally representative pooled data from the Korea National Health and Nutrition Examination Survey (KNHANES), 2007–2013	Education, household income and residence	Education, household income, and residence	<p>This study found that individuals with CKD were more likely to be obese and have hypertension or diabetes than individuals without CKD. In particular, male and less-educated CKD patients were less likely to adhere to the guidelines</p> <p>Since a variety of demographic and socioeconomic factors are related to the successful implementation of guidelines for preventing and managing CKD, individually tailored prevention activities should be developed.</p> <p>Among individuals with CKD, being male or less educated corresponded to a lower likelihood of following the guidelines for preventing and managing CKD; therefore, efforts to improve the adherence to such guidelines may need to be tailored specifically to those groups.</p>	No	Mostly focused on the prevention of CKD
18. Martin-Clearly and Ortiz 2014	Worldwide	Review	Review	Poverty	Poverty	<p>The increasing CKD burden occurs in the context of lack of access of most of the world population to adequate healthcare and an incomplete understanding of the pathogenesis of CKD. However, CKD is not homogeneously distributed. CKD hotspots are defined as countries, region, communities or ethnicities with higher than average incidence of CKD. Analysis of CKD hotspots has the potential to provide valuable insights into the pathogenesis of kidney disease and to improve the life expectancy of the affected communities. Examples include ethnicities such as African Americans in the USA or aboriginals in Australia, regions such as certain Balkan valleys or Central America</p> <p>The importance of socioeconomic factors cannot be downplayed in this and other CKD hotspots around the world. How exactly socioeconomic factors contribute to CKD should be explored in each different location. If overall socioeconomic conditions cannot be improved, and this may be the case when the global economy is in trouble, correction of specific factors may alleviate the CKD burden. Is it the lack of education and non-compliance with doctors recommendations? Lack of access to medical care? Lack of access to nephroprotective drugs? Excessive use of over-the-counter nephrotoxic drugs? Dietary or traditional medicine habits that promote kidney injury or developmental defects? Poor sanitation and contaminated drinking water? Infection-related kidney injury? Each specific problem may require a different intervention that may also differ for different economically deprived communities.</p>	No	
19. Martins et al. 2012	Worldwide	The purpose of this paper is to examine recent discoveries and data on CKD occurrence and		Poverty/ Developing Countries	Poverty	Disadvantaged populations across the globe exhibit a disproportionate burden of chronic kidney disease (CKD) because of differences in CKD occurrence and outcomes. Although many CKD risk factors can be managed and modified to optimize clinical outcomes, the prevailing socioeconomic and cultural factors in	Some	

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		outcomes in disadvantaged populations and explore strategies for the prevention and treatment of CKD in these populations based on the established guidelines.				<p>disadvantaged populations, more often than not, militate against optimum clinical outcomes. In addition, disadvantaged populations exhibit a broader spectrum of CKD risk factors and may be genetically predisposed to an earlier onset and a more rapid progression of chronic kidney disease.</p> <p>Disadvantaged populations, particularly in developing countries, frequently exhibit multiple risk factors for CKD and harbor nontraditional risk factors such as schistosomiasis, tuberculosis and amyloidosis . Environmental pollution, pesticides, analgesic abuse, herbal medications, and unregulated food additives also contribute to the disproportionate burden of CKD in many disadvantaged populations worldwide</p> <p>The management of CKD in disadvantaged populations requires a comprehensive approach and a detailed attention to the prevailing socioeconomic and cultural factors that often militate against optimum clinical outcomes in these vulnerable persons.</p> <p>Lessons learned from racial/ethnic minorities and socioeconomically disadvantaged persons in the USA may provide insights into the care of similar populations globally.</p>		
20. Morton at al. 2016	Worldwide	Systematic Review	Equity-focused systematic review	Various	Factors of disadvantage included gender, race/ethnicity, religion, education, socio-economic status or social capital, occupation and place of residence.	<p>In methodologically suitable studies among pre-dialysis patients, a significant social gradient was observed in access to healthcare for those with no health insurance and no home ownership. Low income and no home ownership were associated with higher cardiovascular event rates and higher mortality [HR 1.94, 95% confidence interval (CI) 1.27–2.98; HR 1.28, 95% CI 1.04–1.58], respectively.</p> <p>Socially disadvantaged pre-dialysis and dialysis patients experience poorer access to specialist cardiovascular health services, and higher rates of cardiovascular events and mortality than their more advantaged counterparts.</p> <p>Factors of social disadvantage including neighbourhood deprivation [5], low income [6], low socio-economic status (SES) [7] and minority ethnicity [6, 8] are strongly associated with higher rates of CKD. There is also consistent evidence that disadvantaged individuals with CKD have poorer access to quality treatment including kidney transplantation</p>	Some	Focuses on mild to moderate kidney disease but not clear at which point patients were diagnosed as so broad. Mostly focuses on outcomes rather than development of CKD
21. Nicholas et al. 2015	America	Review	Review	SES status/Poverty	Defined as less than 200% federal poverty level (FPL)	<p>Socioeconomics may exert both interdependent and independent effects on CKD and its complications and may confound racial and ethnic disparities. Socioeconomic constellations influence not only access to quality care for CKD risk factors and CKD treatment but may mediate many of the cultural and environmental determinants of health that are becoming more widely recognized as affecting complex medical disorders</p> <p>Socioeconomically disadvantaged populations across the globe</p>	Yes	

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						<p>exhibit a disproportionate burden of CKD often complicated by the inability to receive evidence-based care leading to suboptimum clinical outcomes. These include, but are not limited to discrimination and segregation, substandard living conditions, limited quality health care to the uninsured or underinsured, limited health literacy, poor educational systems, and chronic stress that result in measureable and quantifiable pathologic factors that contribute to and enhance the development of CKD and eventually to ESRD and premature mortality</p> <p>The World Health Organization Commission on Social Determinants of Health has found that poor health of low-income persons is directly related to the social gradient in health within and across countries caused by the unequal distribution of power, income, goods, and services, globally and nationally</p> <p>An individual's SES may actually considerably affect one's perception of seemingly mundane matters such as food, education, language, and time. Indeed, although these concepts may be apparent and easily recognizable in other social disciplines, their presence and implications may be lost or concealed to many in the medical arena</p> <p>An analysis from the baseline examination data of the Jackson Heart Study assessed CKD status (albuminuria or eGFR ,60 mL/min/1.73m2) in over 3400 African American adults living in the Tri-County region of the Jackson, MS, metropolitan area, and found that high SES participants (family income at least 3.5 times the FPL or having at least 1 undergraduate degree) were associated with a 41% lower odds of prevalent CKD than their less affluent counterparts</p> <p>In a cohort of nearly 2500 community dwelling black and white adults aged 30 to 64 years residing in Baltimore City, MD, stratified by SES (household income ,125% FPL or higher). Crews and colleagues found that low SES was independently associated with a 59% greater odds of CKD prevalence after adjusting for demographics, insurance status, and comorbid disease, but there was no difference by race. However, when stratified by race, low SES was associated with CKD in African Americans, but not in whites, suggesting that the role of SES to CKD may differ across racial/ethnic groups</p> <p>The impact of individual or household income vs community poverty level on CKD outcomes is not clear. To investigate this issue, McClellan and colleagues reported data from over 22,000 participants in the Reasons for Geographic and Racial Differences in Stroke cohort study in the Southeast United States, finding household income (,\$15,000) vs community poverty (\$25% of the community households were below the FPL), and found that household income, but not community poverty, was independently</p>		

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						associated with CKD (eGFR 10-59 mL/min/ 1.73 m ²) prevalence. They also found that adjusting for household income attenuated but did not fully account for the higher CKD prevalence in blacks compared with whites		
22. Oates et al. 2017	America	This descriptive study examines sociodemographic differences in the distribution of chronic diseases and health-related behaviours in the Mid-South versus the rest of the U.S., identifying subgroups at increased risk of chronic disease	Data were obtained from the 2013 Behavioural Risk Factor Surveillance System; analyses were completed in January 2016. Twelve chronic health conditions were assessed: obesity, diabetes, high blood pressure, coronary heart disease, myocardial infarction, stroke, chronic kidney disease, cancer, arthritis, asthma, chronic obstructive pulmonary disease, and depression. Evaluated health-related behaviors included smoking, physical activity, and fruit and vegetable consumption. Age-standardized percentages were reported using complex survey design parameters to enhance generalizability	Income/ Education	Income/Education	<p>The Mid-South population had increased rates of chronic disease and worse health-related behaviours than the rest of the U.S. population. Mid-South blacks had the highest percentages of obesity, diabetes, high blood pressure, and stroke of all subgroups, along with lower physical activity and fruit and vegetable consumption. In both races and regions, individuals with lower income and education had higher rates of chronic disease and unhealthy behaviours than those with higher income and education</p> <p>In the Mid-South, CKD disparities by income were greater among blacks than whites, whereas the opposite was true outside the Mid-South</p> <p>Similarly, Mid-South women of either race had more pronounced education-level than income level disparities in CKD</p> <p>These racial disparities in CHC burden go hand in hand with socioeconomic disparities: Mid-South black women have the highest unemployment and the lowest annual income of all subgroups, whereas Mid-South black men have the lowest educational attainment and the second highest unemployment and low income; they also have the lowest rates of healthcare coverage. Because of such parallels between racial and socioeconomic health disparities, some have argued that race is not a determinant of health.³The concept of a determinant requires a mechanism of action, and there is little proof that race by itself produces differential health outcomes.³¹ Rather, it is the convergence of socioeconomic, environmental, and cultural factors along racial lines that results in health disparities by race.</p>	No - too specific to regions of the USA	Broad study looking at various health inequalities not just CKD
23. Patzer and McClellan 2012	America	Review	Review	Income/ Education	Most of the evidence discussed below defines SES using the commonly available metrics of income, education and occupation. Although these proxy measures might not entirely capture an individual's SES, they remain the most accessible means of assessing SES	<p>Low socioeconomic status (SES) influences disease incidence and contributes to poor health outcomes throughout an individual's life course across a wide range of populations. Low SES is associated with increased incidence of chronic kidney disease, progression to end-stage renal disease, inadequate dialysis treatment, reduced access to kidney transplantation, and poor health outcomes</p> <p>Educational attainment among individuals screened for high risk of CKD is inversely associated with an increased prevalence of hypertension, diabetes mellitus, decreased eGFR, and increased urinary albumin excretion</p>	Yes	

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						<p>The association between CKD and economically disadvantaged groups throughout the world suggests that circumstances intrinsic to SES that are shared by these individuals are fundamental to the occurrence and outcomes of their disease</p> <p>Growing evidence indicates that community-level and individual-level SES factors independently influence risk factors for the occurrence and progression of CKD throughout an individual's life course through mechanisms that are, as yet, not well understood</p> <p>Socioeconomic status (SES) contributes to the variability in incidence, prevalence and treatment of chronic kidney disease and end-stage renal disease</p>		
24. Peralta et al. 2006	America		Cross-sectional and longitudinal		Income <\$8000 per annum	<p>In contrast, self-reported African-American race was strongly associated with increased risk for kidney disease progression compared with white individuals for change in creatinine (OR 1.77; 95% CI 1.33 to 2.36) and for change in eGFR (OR 3.21; 95% CI 2.54 to 4.06). Among self-identified African Americans, low income (<\$8000/yr) was strongly associated with prevalent kidney dysfunction by cystatin C >1.29 g/dl (adjusted OR 2.7; 95% CI 1.0 to 7.5) or by eGFR <60 ml/min per 1.73 m² (adjusted OR 3.2; 95% CI 1.1 to 9.4) compared with those with incomes >\$35,000/yr.</p> <p>Low income (\$8000/yr) was strongly associated with renal function among African Americans. In adjusted linear models, low income was associated with cystatin C levels that were 0.13 mg/L higher (P 0.038 for linear trend) than in those with incomes \$35,000/yr. When adjusting for African ancestry, this difference was augmented to 0.16 mg/L (P 0.014 for linear trend). Participants with lower incomes had eGFR that was 7.18 ml/min per 1.73 m² lower than those with higher incomes (P 0.017), and this difference remained significant (P 0.02) after adjustment for genetic ancestry. Low income was significantly associated with kidney dysfunction when using cystatin C 1.29 mg/L (or highest quartile) or eGFR 60 ml/min per 1.73 m², compared with those with highest incomes (\$35,000/yr; Table 3).</p> <p>Education and occupation were not significantly associated with kidney function in adjusted analyses (P 0.20). In contrast, low income was not associated with kidney dysfunction among self-identified white individuals for cystatin C 1.29 mg/L (odds ratio 0.81; 95% confidence interval 0.56 to 1.17) and for eGFR 60 ml/min per 1.73 m² (odds ratio 0.78; 95% confidence interval 0.55 to 1.11)</p>	Some	Explores the relationship between low income and African-Americans so is only applicable to this group.
25. Plantiga 2013	Worldwide	Socio-economic status (SES) may be conceptualized as an individual's position in society, as determined by their income, occupation, education,	Literature searches were conducted in the US National Library of Medicine, National Institutes of Health, PubMed database using the	Various	Determined by their income, occupation, education, wealth, and housing situation	<p>Income is the most-studied aspect of SES in relation to CKD, but there is increasing literature involving occupation and education as well.</p> <p>Additionally, the associations of CKD and its outcomes with area-level and life course SES are both burgeoning areas of research</p>	Yes	

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		wealth, and housing situation. This review summarizes the current literature regarding associations of these markers of SES with both chronic kidney disease (CKD) and associated poor outcomes	search terms “chronic kidney disease” and “chronic renal insufficiency,” combined with “socio-economic status,” “income,” “occupation,” “employment,” “education,” “social class,” “wealth,” and “housing.” Articles not in the English language, using nonhuman subjects, or primarily concerning subjects with ESRD or acute kidney injury were excluded			<p>SES may be conceptualized as an individual’s position in society along a “SES gradient” that is determined by their income, occupation, education, wealth, and/or housing situation. Through such diverse mechanisms as access (to nutrition, physical activity, health information, and/or treatments), stress, and environmental triggers, these markers of SES may be associated—both directly and through diabetes and hypertension—with both CKD and associated poor outcomes.</p> <p>Although it has only recently been studied in earlier stages of CKD, income is, by far, the most-studied of the SES components with respect to CKD. In 1999, Krop et al. [16] found that reported income less than \$16,000 versus greater than \$35,000 was associated with 2.4-fold greater risk of incident early kidney function decline (0.4 mg/dl increase in creatinine over 3 years) among persons aged 45–64 with diabetes in the longitudinal Atherosclerotic Risk in Communities (ARIC) study</p> <p>Even among a cohort of persons with CKD [the Chronic Renal Insufficiency Cohort (CRIC) study], the prevalence of having eGFR less than 30 was 37% in those with income less than \$25,000 but only 6% in those with income greater than \$100,000</p> <p>Information on occupation as a risk factor for CKD or its outcomes is less abundant. A case-control study in Sweden [33] showed that individuals with CKD were more likely to come from families with only unskilled workers compared to families with professional workers. In a Brazilian study [28], among those with CKD, those in the lowest occupational grades, including those who did only unskilled work or casual or no work, were more likely to have depressive symptoms relative to those in higher grades with CKD. Similarly, lower occupational grade was cross-sectionally associated with greater odds of decreased eGFR in a United Kingdom study</p> <p>Additionally, NHANES data showed that unemployed non-Hispanic black and Mexican-Americans in the United States had greater than 2-fold greater prevalence of CKD relative to their employed counterparts</p> <p>Education has been studied frequently as a potential risk factor for CKD, but rarely in isolation. In the ARIC study [16], individuals with less than a high school education had 1.7 times the risk of kidney function decline versus those with a college education. Similar associations were seen in the Jackson Heart Study [17] and in a population-based case-control study in Sweden</p> <p>Finally, in an observational cohort of the Kidney Early Evaluation Program (KEEP) study, Choi et al. [43] found that lower educational attainment was associated with greater prevalence of CKD and</p>		

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						higher mortality in those in the cohort who had chronic disease, including CKD.		
26. Said and Hernandez 2015	America/ Worldwide	In this article, we summarize the excess risk of environmental exposures among minority and disadvantaged populations	Review	Environmental Pressures of low SES	Low income/education	<p>Poverty and social disadvantage are associated with a higher risk of CKD and CKD progression. Additionally, it appears that the relationship between poverty, low socioeconomic status, and kidney disease may be different among racial and ethnic minorities compared with whites</p> <p>In the case of low-level lead exposure, there is growing evidence of its role as an independent risk factor for progression of CKD regardless of the cause of CKD. Race, ethnicity, low socioeconomic status, and poverty contribute to a higher burden of exposure to potential environmental nephrotoxins which in turn may partially explain the excess risk of kidney disease</p> <p>Despite successful reductions in the level of environmental exposure to lead in the overall US population, disparities persist. The National Health and Nutrition Examination Survey (NHANES) has shown that although blood lead levels in the US adult population have decreased significantly from the periods 1988 to 1994 and 1999 to 2002, significant differences in exposure remain among racial and ethnic minority groups, and the poor</p> <p>Adults with a low socioeconomic status had a higher burden of exposure. Specifically, after adjusting for age, race, ethnicity, and gender, the odds ratio of having a blood lead level of 5 mg/dL or more was 1.74 (95% confidence interval [CI], 1.23-2.46) for adults with an annual household income less than \$20,000, 2.62 (95% CI, 1.95-3.52) for adults lacking health insurance, 2.17 (95% CI, 1.61-2.93) for adults living in housing built before 1978, and 2.67 (95% CI, 1.83- 3.90) for adults with less than a high school education</p> <p>Chronic high-level exposure to lead in the environment or in the occupational setting is known to cause lead nephropathy, a chronic tubulointerstitial nephritis</p> <p>There is growing data suggesting that lower levels of lead exposure, previously thought to be acceptable (blood lead levels ,5-10 mg/dL), may be a risk factor for the development of CKD and the progression of established CKD</p>	Some	
27. Shoham et al. 2005	America	This article covers the role SES may play in initiating and promoting chronic kidney disease (CKD) in the United States, with an emphasis on life-course SES.	Review	Income/ Education	Income/Education	Krop et al. found that individuals who live in households with incomes below \$16,000 per year have 2.38 times the risk of early kidney function decline as those who lived in households making at least \$35,000 per year; individuals with less than a high school education had 1.67 times the risk of kidney function decline as those with a college education. Klag et al found that the median income of a subject's neighborhood was associated with elevated serum creatinine. A case-control study by Forel et al in Sweden found that	Yes	

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						<p>individuals with CKD had 1.6 times the risk of being unskilled manual workers as those without kidney failure (reference: professionals). Furthermore, individuals with CKD had 1.4 times the risk of having low educational attainment (reference: over 12 years of education). These associations persisted after adjustment for age, sex, body mass index, smoking, alcohol consumption, and analgesic usage.</p> <p>Kuh et al state that “health-damaging exposures or health-enhancing opportunities are socially patterned”; that is, the exposures and opportunities “are constrained by various forms of social stratification.” These patterns must be taken in geographic and historical context, as the forms of social stratification may change over time.</p>		
28. Shoham et al. 2007	America	Persons belonging to the working class or living in an adverse social environment at particular periods of their life course may have an increased risk of chronic kidney disease (CKD)	This hypothesis was examined among participants of the Life Course Socioeconomic Status Study, an ancillary study of the Atherosclerosis Risk in Communities Study, conducted in 2001 (mean age, 67.4 years; N 12,631). CKD was defined by hospital discharge diagnosis and/or estimated glomerular filtration rate less than 45 mL/min/1.73 m ² (0.75 mL/s/1.73 m ²). Social class was categorized as working class or non-working class at ages 30, 40, or 50 years. Area-level socioeconomic status was based on a composite of census scores during the same period. Adjusted odds ratios were obtained within strata of white and African-American race	Class and area-level socioeconomic status	<p>Social class, defined as the place individuals occupy in power or authority relationships in the workplace</p> <p>Area-level SES was assessed by linking the geocoded historic addresses of respondents with decennial census data</p>	<p>The adjusted odds ratio of CKD for persons belonging to the working class versus non-working class at age 30 was 1.4 (95% confidence interval, 1.0 to 2.0) in whites and 1.9 (95% confidence interval, 1.1 to 3.0) in African Americans. Working class membership was associated with CKD, even at earlier stages of adult life, and class was associated more strongly with CKD than was education. Working class membership also suggested a stronger association with CKD among African Americans than whites, independent of diabetes and hypertension status. At later periods in the life course, area socioeconomic status was associated with CKD.</p> <p>Adverse social conditions measured at the census-tract level were associated with diverse outcomes, including coronary heart disease, low birth weight, and lead poisoning.</p> <p>Subjects with CKD tended to have lower educational attainment and area SES scores and were more likely to have been members of the working class at each age period. Education was statistically significantly different between cases and noncases among both races. Among whites, only working class status at age 40 was related significantly to CKD; among African Americans, working class status was associated with CKD at ages 30, 40, and 50. Area SES scores diverge between whites and African Americans during subsequent decades and were related significantly to CKD for age-50 area SES among both race groups</p> <p>Not completing high school is associated with an increased odds of CKD compared with those with a college degree or more: among whites, the OR was 1.7 (95% CI, 1.2 to 2.5), and among African Americans, the OR was 1.6 (95% CI, 1.1 to 2.5). Further adjustment for area SES, center, father’s education, and father being a farmer attenuated the association between education and CKD by 35% among whites and by 42% among African Americans. Adjustment for hypertension and diabetes mellitus all but eliminated the education association among both whites and African Americans.</p>	Yes	Interesting class based approach to social deprivation not completely tied to income

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						We found that being a member of the working class was associated with CKD among the ARIC LCSES population, even at earlier stages of the adult life course. Results suggest that the strength of association between being working class and CKD is stronger among African Americans than whites. At later periods in the life course, area SES is associated with CKD. Individual education level also is associated with CKD, but adjustment for confounders and mediators reduced the strength of association. There were no associations between parental class or childhood area SES measures and CKD.		
29. Shoham et al. 2008	America	The authors investigated the cumulative effects of life course social class and neighborhood socioeconomic conditions on the prevalence of chronic kidney disease (CKD) in adulthood.	Subjects were members of the Atherosclerosis Risk in Communities (ARIC) Study, a longitudinal cohort study of four US communities. CKD was defined by glomerular filtration rate <45 ml/min/1.73 m ² or hospital discharge diagnosis. Working class was defined by workplace roles for subjects and their fathers; area socioeconomic status (SES) was based on census information	Class and area-level socioeconomic status	<p>As above</p> <p>A cumulative measure was created based on subject's father's social class (a proxy for childhood socioeconomic position) and subjects' own social class at age 30, 40, and 50. Subjects were placed into one of three categories based on the cumulative measure: working class across the life course; working class during at least one period (but not all four periods); and non-working class across the life course.</p> <p>Next, the number of life course periods spent living in low SES area was summed. Living in a low SES area for all periods thus yielded a score of 4, while 0 was the score for those never having lived in a low SES area; those who lived in a low SES area for some but not all periods of the life course had a score of 1, 2, or 3. Tests of trend were conducted for both social class and area SES in the following manner:</p>	<p>Being working class for all life course periods or for some life course periods was associated with increased odds of CKD, compared to being non-working class for all periods (adjusted odds ratio, OR, for all periods (95% confidence interval) 1.4 (0.9, 2.0) in Whites and 1.9 (1.3, 2.9) in African-Americans; OR for some periods 1.3 (1.0, 1.9) in Whites and 1.4 (0.9, 2.2) in African-Americans). Low area SES over the life course was not significantly related to CKD compared to living in a higher SES areas at all life course periods. Adjustment for age, gender, community of residence, cumulative social class (for neighborhood measures), cumulative low-neighborhood SES (for cumulative individual social class), hypertension and diabetes does not account for these associations</p> <p>Among Whites, there was a 40% increase in CKD odds associated with being working class at either some or all periods, compared to being non-working class at all periods (p-value for trend 0.04).</p> <p>Increasing life-periods spent in the working class thus means decreasing periods with at least some degree of power. Adjustment for age, gender, study center, area-level SES hardly attenuated the ORs; the associations were largely independent of diabetes and hypertension.</p> <p>Similar yet stronger associations were seen among African-Americans, who showed a graded response to increasing odds of CKD by increasing proportion of the life course spent in the working class (p for trend <0.01).</p> <p>Among both races, the cumulative effects of living in a low SES area were inconsistent and not statistically significant.</p> <p>The number of periods a person was working class over the life course was generally related to CKD in adulthood in a graded manner; this dose response was statistically significant among African-Americans. The cumulative association of living in a low SES area with CKD risk was weak and not statistically significant. Neither confounding (by age, gender and study center) nor mediators (hypertension and diabetes) accounted for these associations.</p>	Yes	Interesting class based approach to social deprivation not completely tied to income. Reference to Bourdieu and habitus

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					being working class (or living in a low SES area) at all four periods was coded as a score of 1; at some but not all (1–3 out of 4) periods was scored 0.5; and no periods working class (or living in a low SES area) was scored 0.			
30. So et al. 2015	UK (Scotland)	Primary care chronic kidney disease (CKD) registers report widely varying prevalence within the UK. We examined the effects of laboratory ascertainment and adjusting for practice-level variables on the variation in CKD prevalence. We carried out an Ayrshire-wide laboratory database analysis of primary care practices (PCPs).	We analysed 54 PCPs with 313 639 registered patients aged ≥18. All patients with a low estimated glomerular filtration rate (<60 mL/min/1.73 m ²) had their serum creatinine values extracted from 1st January 2009 to 31st March 2012. Individuals with CKD stage 3–5 were identified with an algorithm that confirmed chronicity. These data were linked to PCP attributes from Information Services Division, Scotland. Using laboratory-ascertained CKD prevalence, we examined whether adjusting for practice-level factors [socio-economic status (SES), rurality and patients to general practitioner ratio (PGR)] and patient-level factors (age, gender) explained some of the observed variation among PCPs. Individual and	Socioeconomic status	Socioeconomic status	<p>Eighteen thousand two hundred and eighty-five [patients] (5.8%) had CKD stage 3–5 on 31 March 2011. SES, rurality and PGR predicted 39% ($F(3,50) = 12.37$, $P < 0.001$) of the variation in prevalence with SES exerting the most influence (25%). With the stepwise addition of explanatory variables, variation between practices fell from 3.9-fold using PCP register prevalence to laboratory ascertained (3.1-fold variation), with age and gender adjustment (further fall to 2.1-fold), and lastly to 1.8-fold variation with adjustment for SES.</p> <p>Over a third of variation in CKD prevalence among PCPs can be explained by rurality, PGR and especially SES even after age and gender stratification.</p> <p>After standardization for age and gender, SES was found to have a strong positive association with CKD prevalence</p> <p>In a stepwise multivariate regression model, SES, rurality, mean age and PGR were included as independent variables against the dependent variable, AGP. The strongest and most parsimonious model to emerge (Table 3) features only SES, rurality and PGR. The coefficients are positive, indicating that higher standardized CKD prevalence is associated with poorer SES and rurality and with more PGR. These three factors combined explained 39% (adjusted $R^2 = 0.392$) of the variability in prevalence ($F(3,50) = 12.37$, $P < 0.001$). SES was the single most influential predictor, accounting for 25% of the variability.</p> <p>We found a linear relationship between CKD prevalence and the mean SES of the population served by PCPs.</p> <p>The mechanism by which low SES is associated with increased CKD prevalence is not clear. Other factors associated with CKD are known to be more common in lower SES populations, including obesity, smoking, diabetes mellitus and vascular disease and so low SES may simply be a composite marker for these.</p>	Yes	

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			combined hierarchical multilinear regression models were used.					
31. Thawornchaisit et al. 2015	Thailand	Chronic kidney disease (CKD) is becoming a major health challenge worldwide as its aetiology has transferred from predominantly infectious disease to emerging chronic diseases, especially diabetes and hypertension. A rapid health-risk transition driven by economic development is transforming Thailand which is now becoming an ageing country where chronic diseases are a major health burden.	This study used the 2005 baseline cross-sectional dataset of 87 143 Thai Cohort Study members to investigate risk factors associated with CKD. Using multivariate logistic regression, we looked into the relationship between CKD and demographic and socioeconomic factors, personal health status and various health-related behaviours.		Income, household assets, and education	<p>In men, CKD was associated with living in rural areas [and] having a low income</p> <p>There was no distinctive trend observed between socio-economic status and prevalence of CKD in bivariate analyses. After adjustment for other variables, this finding remains for females but not in males. The odds of having CKD in males decline as income and asset values increased (ORs drop from 1 to 0.71 for rising incomes, $p < 0.05$; ORs from 1 to 0.78 as asset values increase, $p < 0.05$).</p> <p>Socio-economic status (SES) has a negative effect on CKD as results showed in this study and in others conducted in India (Anupama & Uma, 2014), America (Klag et al., 1997; Krop et al., 1999; Perneger, Whelton, & Klag, 1995; White et al., 2008), Thailand (White et al., 2008) and Sweden (Fored et al., 2003). The effect of SES on CKD might have been due to poor dietary habits of lower SES groups. Crews et al. (2012) suggested that low income people may have poor diet and biological and psychological states which may lead to autonomic nervous system impairment reducing the ability to tolerate external stress which may cause endothelial injury.</p>	Some	
32. Vart et al. 2015a	Worldwide	Therefore, the aim of the study was to (1) summarize the strength of the association between SES and CKD (measured by low estimated glomerular filtration rate [eGFR], high albuminuria, low eGFR/high albuminuria, and renal failure) in a systematic review and metaanalysis and (2) identify study-level characteristics related to the strength of the association between SES and CKD.	Systematic Review	Various	Various	<p>Low SES was associated with low eGFR (OR$\%1.41$, 95% CI$\%1.21$, 1.62), high albuminuria (OR$\%1.52$, 95% CI$\%1.22$, 1.82), low eGFR/high albuminuria (OR$\%1.38$, 95% CI$\%1.03$, 1.74), and renal failure (OR$\%1.55$, 95% CI$\%1.40$, 1.71). Differences in SES measures across studies were not related to the strength of associations between low SES and any of the CKD measures (low GFR, $p\%0.63$; high albuminuria, $p\%0.29$; low eGFR/high albuminuria, $p\%0.54$; renal failure, $p\%0.31$).</p> <p>Socioeconomic disparities in CKD were fairly strong, irrespective of how SES was measured. Variations in the strength of the associations were related to the level of covariate adjustment, particularly for low eGFR and high albuminuria</p> <p>Low SES has not yet been identified in clinical guidelines as a high-risk factor warranting screening for CKD, although CKD has been shown to be associated with low SES</p> <p>Variation in the association between SES and CKD across studies might be due to methodologic or real differences. Methodologic differences may concern how SES and CKD are defined, study design, level of adjustment for covariates, and number of SES categories. The “real” association between SES and CKD may also differ by region and by baseline risk of the study populations. For example, in</p>	Yes	Excellent systematic review

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						<p>industrialized countries, studies demonstrate an inverse association between low SES and CKD, whereas in industrializing countries the association can be positive. Furthermore, certain population subgroups (e.g., African Americans) show larger relative SES differences than others (e.g., whites and Asians in the U.S.).</p> <p>The most commonly assessed SES measures were education and income (Table 1). Less frequently assessed SES measures were occupation, composite, and area-level SES measures</p> <p>The results of this study suggest that compared to those with high SES, people with low SES have a fairly strong association with CKD defined by low eGFR, high albuminuria, low eGFR/high albuminuria, or renal failure. Different definitions of SES were not related to the strength of associations between low SES and any of the CKD measures</p> <p>Each SES measure represents an important but not entire socioeconomic context of an individual or a group. Unfortunately, information on all SES measures is rarely available, and there is no standardized SES measure that is applicable across populations. Therefore, studies use different measures to define SES</p> <p>Findings in this review indicate that SES is associated with CKD, irrespective of how SES is measured. This may be interpreted as that both access to resources and prestige or place in the social hierarchy within a society are relevant regarding the likelihood of having CKD</p> <p>Variables like race, gender, family structure, and geography can interact with SES in association between SES and CKD. For example, at the same level of education, African Americans are more likely to experience unemployment or have lower income than whites in the U.S. A similar trend might be true for women. Consequently, the effect of low education on CKD might be different across races and genders.</p> <p>Further, health behaviours (e.g., smoking and alcohol use) and comorbid conditions (e.g., hypertension and diabetes) lie on the causal pathway between SES and poor health, and therefore are more likely to be mediators in the SES–CKD association than confounders</p>		
33. Vart el al. 2015b	America	Using data collected from 9,823 participants in the 2007–2008 and 2009–2010 cycles of the National Health and Nutrition Examination Survey, we formally	Cross-sectional	Poverty	Poverty income ratio	In mediation analyses, we tested the contributions of health-related behaviours (smoking, alcohol intake, diet, physical activity, and sedentary time), comorbid conditions (diabetes, hypertension, obesity, abdominal obesity, and hypercholesterolemia), and access to health care (health insurance and routine health-care visits) to this association. Except for sedentary time and diet, all examined health-related behaviours, comorbid conditions, and factors related to health-care access mediated the low SES–CKD association and	Yes	Good explanatory study into relationship between factors associated with SES and CKD. Not clear on whether this is directly

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		investigated potentially modifiable factors linking low socioeconomic status (SES) to chronic kidney disease (CKD) for their presence and magnitude of mediation				<p>contributed 20%, 32%, and 11%, respectively, to this association. In race/ethnicity-specific analyses, identified mediators tended to explain more of the association between low SES and CKD in non-Hispanic blacks than in other racial/ethnic groups. In conclusion, potentially modifiable factors like health-related behaviours, comorbid conditions, and health-care access contribute substantially to the association between low SES and CKD in the United States, especially among non-Hispanic blacks</p> <p>The relationship between low SES and CKD was statistically significant after adjustment for age, sex, and race (P <0.001)</p> <p>Table 2 shows that changing SES from the highest level to the lowest level increased the odds of CKD (odds ratio = 1.64, 95% confidence interval: 1.42, 1.89)</p> <p>Smoking, alcohol intake, and physical inactivity contributed 8%,7%, and 4%, respectively, to the total effect of low SES on CKD. Twenty percent of the total effect of SES on CKD was explained by health-related behaviours. Regarding comorbid conditions, the direct as well as indirect effects operating via diabetes, hypertension, obesity, abdominal obesity, and hypercholesterolemia were significant. Diabetes and hypertension explained 13% and 7% of the association between low SES and CKD, respectively; obesity and abdominal obesity explained 4% each; and hypercholesterolemia explained 3%. Comorbid conditions together explained 32% of the association between low SES and CKD.</p> <p>Among factors related to health-care access, the indirect effects operating via the health insurance pathway and health-care visits were significant and contributed to the association between low SES and CKD by 6% and 5%, respectively. Factors related to health-care access together contributed 11% to the SES-CKD association</p>		related to chances of developing CKD.
34. White et al. 2008	America, Australia and Thailand	We sought to determine whether an elevated burden of chronic kidney disease is found among disadvantaged groups living in the United States, Australia, and Thailand	We used data on participants 35 years or older for whom a valid serum creatinine measurement was available from studies in the United States, Thailand, and Australia. We used logistic regression to analyze the association of income, education, and employment with the prevalence of	Income	Income	<p>Age- and gender-adjusted odds of having chronic kidney disease were increased 86% for US Whites in the lowest income quartile versus the highest quartile (odds ratio [OR]=1.86; 95% confidence interval [CI]=1.27, 2.72). Odds were increased 2 times and 6 times, respectively, among unemployed (not retired) versus employed non-Hispanic Black and Mexican American participants (OR=2.89; 95% CI=1.53, 5.46; OR=6.62; 95% CI=1.94, 22.64. respectively). Similar associations were not evident for the Australian or Thai populations.</p> <p>There is strong evidence that low socioeconomic status (SES) is associated with elevated rates of cardiovascular morbidity and mortality. Recent reports have observed similar associations between SES and the prevalence and progression of chronic kidney disease</p> <p>Higher kidney disease prevalence among financially disadvantaged</p>	Yes	

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			chronic kidney disease (estimated glomerular filtration rate<60 mL/min/1.73 m2).			<p>groups in the United States should be considered when chronic kidney disease prevention and management strategies are created. This approach is less likely to be of benefit to the Australian and Thai populations</p> <p>Income in the lowest quartile, shorter duration of education, and being unemployed were associated ($P<.01$) with significantly increased odds of eGFR at less than 60 mL/min/1.73 m2 on crude analysis among US non-Hispanic Whites, US non- Hispanic Blacks, the Thai population, and the Australian population (Table 3). Education level was not significantly associated with chronic kidney disease prevalence among Mexican Americans, although point estimates were similar to those for other ethnic groups, and the wide confidence intervals probably result from the smaller size of this group.</p> <p>Testing for trend across income quartile groups indicated a significant negative gradient in the age- and gender-adjusted association between income group and prevalence of eGFR at less than 60 mL/min/1.73 m2 among the US White ($P = .002$) and non-Hispanic Black ($P=.04$) populations. That is, the odds of prevalent chronic kidney disease increased with descent in income group for these populations. A gradient effect of education is also suggested for non-Hispanic Blacks, whereby the odds of prevalent chronic kidney disease increased with lower categories of educational attainment. None of the results for the Australian or Thai populations was significant after adjustment for age and gender, and there was no evidence of a gradient in the effect of income for either population. Adjusting for diabetes and hypertension status (Table 3, model 3) and additional potential explanatory variables (Table 3, model 4) did not substantially alter these findings</p> <p>It is postulated that education, income, and employment have an impact on health via such mechanisms as deprivation in infancy and childhood, poor diet and nutrient intake, fewer leisure-time activities, lack of social support, and housing and monetary difficulties. Other factors relevant to chronic kidney disease prevalence may include exposure to infection, environmental toxins, and poor fetal nutrition influencing kidney development and subsequent function. Differences in access to health care and health insurance may also play a role, possibly explaining the high residual risks of chronic kidney disease among unemployed non-Hispanic Black and Mexican American participants. SES affects health through complex pathways</p>		
35. Zhang et al. 2012	China	The prevalence of chronic kidney disease is high in developing countries. However, no national survey of	We did a cross-sectional survey of a nationally representative sample of Chinese	Poverty/ Developing Countries	Poverty	<p>In rural areas, economic development was independently associated with the presence of albuminuria</p> <p>Unlike in developed countries, socioeconomic status and the accompanying change in lifestyle has varied substantially between</p>	No	

Author/Date	Country	Study Aims	Study Design	Aspect of Social Deprivation	Definition of Social Deprivation	Key Findings	Applicability to UK	Notes
		chronic kidney disease has been done incorporating both estimated glomerular filtration rate (eGFR) and albuminuria in a developing country with the economic diversity of China. We aimed to measure the prevalence of chronic kidney disease in China with such a survey.	adults.			rural and urban areas in China, especially during the past decade. Several possible explanations for the discrepancy between urban and rural areas exist. First, the same pattern has been reported for other non-communicable diseases including diabetes, which is a risk factor for chronic kidney disease. For example, in a national survey, the prevalence of diabetes increased substantially with economic development in rural areas (from 5·8% in underdeveloped rural areas to 12·0% in developed rural areas), whereas the prevalence of diabetes was similar across economic development categories in urban areas (10·4% in underdeveloped urban areas, 12·0% in developed urban areas). Second, the difference between rural and urban areas might be caused by the disparity in health care between areas in China. A study using data from the China National Nutrition and Health Survey 2002 indicated that the treatment and the control of hypertension were substantially lower in rural areas than in urban areas, which is consistent with our results. Finally, in our analysis, the increased OR of albuminuria in economically developed rural areas still existed after adjustment for status of diabetes and hypertension. We suggest that factors not captured by our study might contribute to the increased risk—eg, unhealthy lifestyle caused by both rapidly increased economic development and reduced health literacy (partly manifested by education level).		